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CORRECTION TABLES FOR ALTITUDE DETERMINING RADARS INFLUENCED BY LOW LEVEL TRAPPING LAYERS

KENNETH W. RUGGLES

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CORRECTION TABLES FOR ALTITUDE-DETERMINING RADARS INFLUENCED BY LOW-LEVEL TRAPPING LAYERS

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Kenneth W. Ruggles

CORRECTION TABLES FOR
ALTITUDE DETERMINING RADARS INFLUENCED
BY LOW LEVEL TRAPPING LAYERS

by

Kenneth W. Ruggles

Lieutenant, United States Navy

Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE

IN

METEOROLOGY

United States Naval Postgraduate School
Monterey, California
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CORRECTION TABLES FOR
ALTITUDE-DETERMINING RADARS INFLUENCED
BY LOW ELEVATION TRAPPING LAYERS

by

Kenneth W. Ruggles

This work is accepted as fulfilling
the thesis requirements for the degree of
MASTER OF SCIENCE
IN
METEOROLOGY
from the
United States Naval Postgraduate School

ABSTRACT

The commonly-used "4/3-Earth Model", in determining radar altitudes, has recently been shown to over-estimate curvature at elevations greater than several kilometers. It is further limited in that provisions are not made to account for commonly-occurring super-refractive atmospheric layers. Based on these shortcomings, a new model is constructed which incorporates an exponential refractivity model proposed by recent investigators, together with superimposed low-level trapping layers of various intensities. From this model, tables of heights are computed for altitude-determining radars. These heights should be considerably more representative than those based on the "4/3-Earth Model."

The author wishes to express his appreciation for the assistance of Professor F. L. Martin and Mr. E. N. Ward of the U. S. Naval Postgraduate School in this investigation.

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LIST OF TABLES

TABLE NO. 1-45 HEIGHT DETERMINATION FOR EXPONENTIAL ATM WITH TRAPPING LAYERS

	TRAPPING LAYER DESCRIPTION			
TABLE	HEIGHT IN FEET	THICKNESS IN FEET	N-GRADIENT	PAGE
1	1000	200	50	17
2	1000	200	100	18
3	1000	200	200	19
4	1000	400	50	20
5	1000	400	100	21
6	1000	400	200	22
7	1000	800	50	23
8	1000	800	100	24
9	1000	800	200	25
10	2000	200	50	26
11	2000	200	100	27
12	2000	200	200	28
13	2000	400	50	29
14	2000	400	100	30
15	2000	400	200	31
16	2000	800	50	32
17	2000	800	100	33
18	2000	800	200	34
19	3000	200	50	35
20	3000	200	100	36
21	3000	200	200	37
22	3000	400	50	38
23	3000	400	100	39
24	3000	400	200	40
25	3000	800	50	41
26	3000	800	100	42
27	3000	800	200	43
28	4000	200	50	44
29	4000	200	100	45
30	4000	200	200	46
31	4000	400	50	47
32	4000	400	100	48
33	4000	400	200	49
34	4000	800	50	50
35	4000	800	100	51
36	4000	800	200	52
37	5000	200	50	53
38	5000	200	100	54
39	5000	200	200	55
40	5000	400	50	56
41	5000	400	100	57
42	5000	400	200	58
43	5000	800	50	59
44	5000	800	100	60
45	5000	800	200	61

SYMBOLS AND ABBREVIATIONS

a	Radius of the earth
a_e	Effective radius of the earth
β_o	Angle of ray emission, relative to the horizontal
β_i	Ray-entrance angle, relative to the horizontal
β_{i+1}	Ray-emergence angle, relative to the horizontal
h	Height of trapping layer
Δh	Thickness of trapping layer
n	Refractive index of atmosphere
N	Refractivity of atmosphere
z	Height, measured from surface of the earth
S	Range
K_r	Relative curvature of ray

1. Introduction

Atmospheric refraction of radar rays can seriously affect the accuracy of surface-based height-finding radars. The purpose of the paper is to consider some models of anomolous atmospheric refraction, and determine corrections necessary to observed radar altitudes in order to provide an accurate target altitude.

Figure 1. Typical radar ray path.

Consider a transmitter, T, in Figure 1, and its target, S. Because of atmospheric refraction, the radar ray path will be, in general, a curved arc, TS. In order to determine accurately the altitude of the target, S, we must be able to predict correctly the curvature of the arc TS along all points of the arc.

In 1933, Schelling, Burrows, and Ferrell [4], set forth the effective earth's radius model to account for the effects of atmospheric refraction, better known as the "4/3-Earth Model". This is to say that if we were to depict the earth as a sphere of some radius suitably larger than that of the real earth, then normally downward bending radar waves could be drawn as straight lines. The accepted

standard effective radius has become 4/3 the radius of the earth.

Recent investigations by Bauer, Mason, and Wilson [1], of Lincoln Laboratories, and Bean and Thayer [2] of the National Bureau of Standards, establishes that the lapse of refractive index, dn/dz, where n is the refractive index and z the height above the earth, is not constant, as it was assumed to be in the 4/3-earth model. These investigators suggest that the revised standard n-profile is more suitably described in the mean by an exponential curve, rather than a linear one, such that:

$$n = 1 + C_1 e^{-C_2 z} \tag{1}$$

where C_1 and C_2 are empirically determined constants.

At this point, let us consider, from a quantitative viewpoint, the effect of the index of refraction on a radar ray. Since n is generally of the order of 1.0003, it is more convenient to discuss its scaled-up counterpart, refractivity, N, where:

$$N = (n-1)10^6 \tag{2}$$

Therefore, if n=1.003, the refractivity is N=300. In the mean, the vertical gradient[1] of N for the lower layers of the atmosphere is 12 units/1000 feet. Substituting this value into the relative curvature equation [see Ref. 2]

$$K_n \doteq \frac{1}{1 + \frac{a}{n}\frac{dn}{dz}} \tag{3}$$

one arrives at a value of relative ray curvature consistent

---

[1] The vertical gradient will be represented by $-\frac{\Delta N}{\Delta Z}$

with the average or "standard" curvature, resulting from the 4/3-earth model. For $-\frac{\Delta N}{\Delta z} = 47.8$ units/1000 feet. Equation (3) shows that the radar-ray curvature is the same as that of the earth. This condition is known as a trapping, or ducting condition. Since vertical N-gradients well in excess of 48 units/1000 feet exist in the atmosphere, the radar-ray path can be significantly altered during its passage through the atmosphere. To illustrate the error this bending introduces in altitude determining radars, consider a transmitter T situated below a superrefractive layer in Figure 2.

Figure 2. Example of trapping.

The solid line TS, is the actual ray path between the target and the transmitter. The dashed line, TS', is the ray path along which one assumes the radar energy has traveled, if the 4/3-earth model applies, and from which the set computes its displayed height. Therefore, the radar set will display a height H', which, as can be seen, constitutes a sizeable departure from the true height, H.

4. [illegible] models.

As explained in Section 2, the 4/3-earth model [illegible] is generally used by most operational radars, is [illegible] with respect to both mean and transient [illegible] atmosphere. One cannot expect to [illegible] model which will account for all the transient [illegible] of the atmosphere. A model can be constructed, however, which will account for certain significant, [illegible], atmospheric conditions, such as trapping. [illegible] in mind, the model depicted in Figure 3 has been constructed.

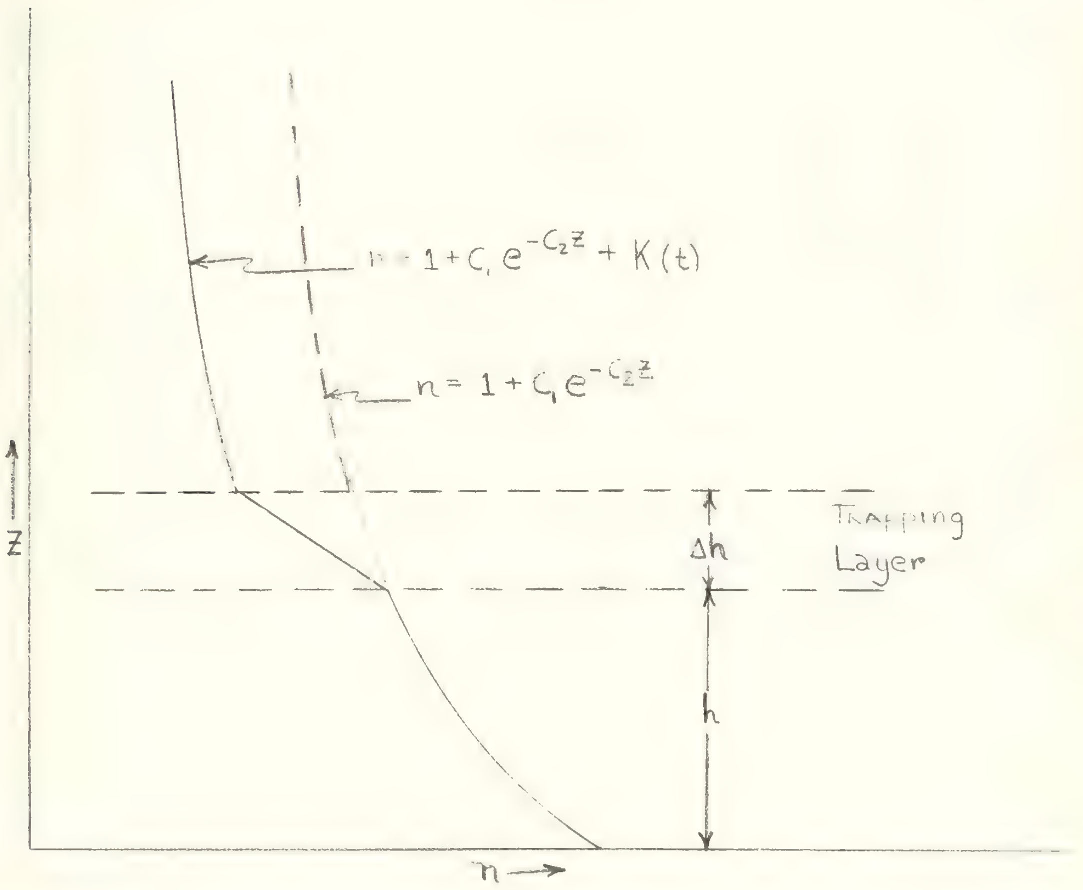

Figure 3. Model atmosphere with trapping layers.

An exponential lapse of n with height has been assumed both below and above the trapping layer, following Equation (1). A single trapping layer has been assumed, of thickness Δh, and exhibiting a linear lapse of n. As can be seen from the geometry of Figure 3 and Equation (1), the value of n at any point below the base, $z = h$, of a trapping layer is expressed:

$$n = 1 + C_1 e^{-C_2 z} \qquad 0 \leq z \leq h \qquad (4)$$

Similarly, the value of n at any point within the trapping layer of thickness Δh can be expressed as:

$$n = \left(1 + C_1 e^{-C_2 h}\right) + \frac{\Delta n}{\Delta h}(z - h) \qquad h \leq z \leq h + \Delta h \qquad (5)$$

Finally, the value of n above the trapping layer can be expressed:

$$n = 1 + C_1 e^{-C_2 z} - C_1 e^{-C_2 h}\left[e^{-C_2 \Delta h} - 1\right] + \frac{\Delta n}{\Delta h}\Delta h \qquad z \geq h + \Delta h \qquad (6)$$

Note that the model just constructed has the same slope dn/dz above the trapping layer as it would have had in the absence of a trapping layer. Whether this is fulfilled in practice is not known; however, this feature of the model is very convenient from a computational viewpoint.

This feature may be stated another way: for any given trapping layer of specified thickness, gradient and height, Equation (6) can be seen to have the form

$$n = 1 + C_1 e^{-C_2 z} + K(t) \qquad (7)$$

where K(t) is a function of the properties of the trapping layer, and is a constant for any set of computations

dealing with any single trapping layer.

Having described the model, the next step is the selection of appropriate values for C_1 and C_2. The investigations of Bean and Thayer [2] have established a value for the constants based on 39 station-years of radiosonde observations, representing an all-season average at 13 climatically diverse locations. On the other hand, Bauer, Mason and Wilson [1] have suggested values for the constants based on a selected set of soundings representing a "cool, dry" spring atmosphere. While the work of Bean and Thayer represents a more precise representation of an average "all cases" sounding, the atmosphere described by Bauer, Mason, and Wilson better approximates an ideal atmosphere into which anomolous conditions can be interjected. Therefore, the values proposed by Bauer, Mason, and Wilson have been used to define the exponential atmosphere, and Equation (1) now becomes:

$$n = 1 + .00032\, e^{-.0371 z} \qquad (\;)$$

where z is measured in kilofeet.

3. Ray geometry.

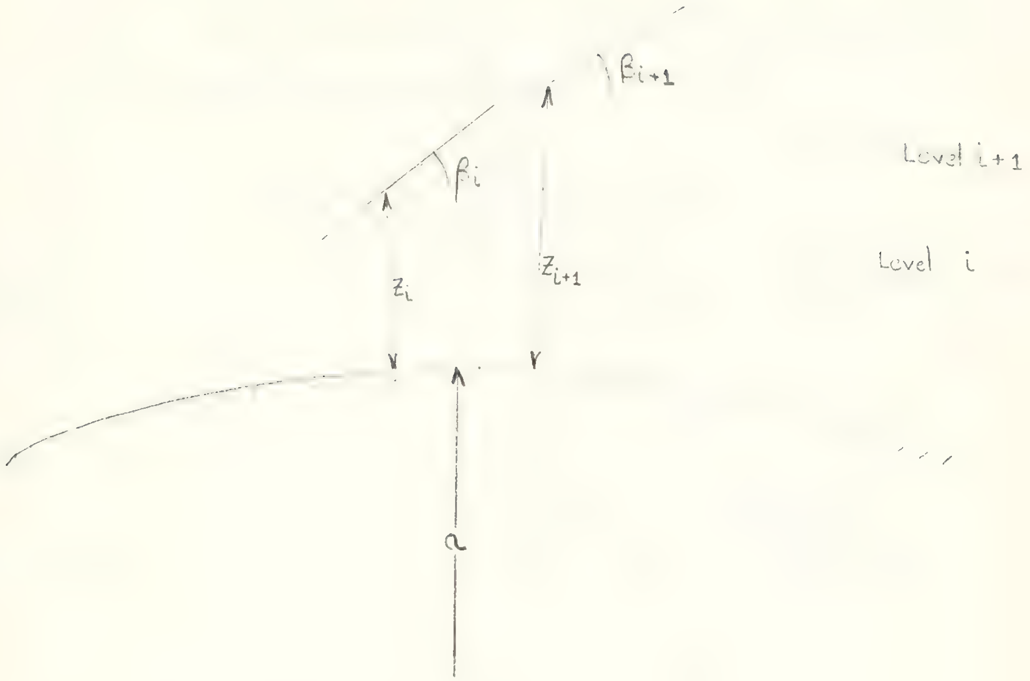

Figure 4. Ray geometry.

Consider the ray in Figure 4 entering a spherically homogeneous layer of the atmosphere with entrance angle β_i, and emerging from the top of the layer with angle of emergence β_{i+1}. Angles β_i and β_{i+1} are always considered to be measured from the local horizontal. Snell's law tells us [3]:

$$n_i(a+z_i)\cos\beta_i = n_{i+1}(a+z_{i+1})\cos\beta_{i+1} = \text{Constant} \qquad (9)$$

where n_i and n_{i+1} are the indices of refraction at bottom and top of this layer respectively; z_i and z_{i+1} are the heights of the points above the surface of the earth; and a is the true radius of the earth[2]. Expressing (9)

---

[2] For the purposes of this paper, the earth is assumed a perfect sphere of radius 20898.908 kilofeet.

in terms of the logarithms of the values, and differentiating with respect to height:

$$\frac{1}{n}\frac{dn}{dz} + \frac{1}{a+z} + \frac{1}{\cos\beta}(-\sin\beta)\frac{d\beta}{dz} = 0$$

Rearranging terms, and noticing that $\frac{d\beta}{dz} = \frac{d\beta}{ds}\frac{ds}{dz} = \frac{d\beta}{ds}\frac{1}{\sin\beta}$ the last equation may be written:

$$ds = \frac{d\beta}{\cos\beta\left[\frac{1}{n}\frac{dn}{dz} + \frac{1}{a+z}\right]} \qquad (10)$$

Replacing the differentials with a finite-difference form, (10) can be written:

$$\Delta s_i = \frac{\beta_{i+1} - \beta_i}{\cos\beta_i\left[\frac{2(n_{i+1}-n_i)}{(n_{i+1}+n_i)(z_{i+1}-z_i)} + \frac{1}{a+\frac{(z_i+z_{i+1})}{2}}\right]} \qquad (11)$$

Using Equation (9) to solve for $\beta_{i+1}-\beta_i$, one obtains:

$$\beta_{i+1}-\beta_i = \left[\cos^{-1}\left(\frac{n_i\,(a+z_i)\cos\beta_i}{n_{i+1}\,(a+z_{i+1})}\right)\right] - \beta_i \qquad (12)$$

Substituting (12) into (11) gives:

$$\Delta s_i = \frac{\left[\cos^{-1}\left(\frac{n_i(a+z_i)\cos\beta_i}{n_{i+1}(a+z_{i+1})}\right)\right] - \beta_i}{\cos\beta_i\left[\frac{2(n_{i+1}-n_i)}{(n_{i+1}+n_i)(z_{i+1}-z_i)} + \frac{1}{a+\frac{(z_i+z_{i+1})}{2}}\right]} \qquad (13)$$

Equation (13) can be numerically solved by the following steps:

1. select small increments $\Delta z_i = z_{i+1} - z_i$, given an initial angle β_i
2. compute Δs_i and β_{i+1} over small thicknesses using Equations (4), (5), (6), (12), and (13)
3. compute range S and height Z where:

$$S = \sum_{i=1}^{n} \Delta s_i \qquad Z = \sum_{i=1}^{n} \Delta z_i \qquad (14)$$

For computations used in this paper, ΔZ_i [illegible] 200 feet.

Let us look for a moment at Equation (12). If n_i is sufficient greater than n_{i+1}, and the ray has a low angle of elevation so that $\cos \beta_i \doteq 1$, the term $\frac{n_i (a+z_i)}{n_{i+1} (a+z_{i+1})} \cos \beta_i$ will become greater than unity. Under these conditions the cosine of an angle cannot exist, and Snell's law fails. Such a condition represents complete reflection of the ray, or trapping. Under these conditions, the height of any target detected by this ray will be less than the height of the top of the trapping layer.

4. Computation procedure

The model as described in Section 2 was computed for the top of the trapping layer at every 1000 feet up to 5000 feet, and for thicknesses of 200, 400 and 800 feet, with N-gradients of 50, 100, and 200 units/1000 feet. These values have been selected so that all commonly-occurring atmospheric trapping layers will lie within the range of parameter values selected, providing a basis for tabular interpolation. Selection of the number of parameters used has been a compromise between complete tabular listings and the size of Appendix 2. The author has tried to select the cases so that both requirements are adequately met, keeping Appendix 2 to such a size that its value will not be lost in its bulk.

The procedure outlined in Section 3 was programmed for the CDC-1604 high speed digital computer. Rays were computed for increments in the initial angle β_0 of one-eighth degree up to one-half degree; then in half-degree increments from 6 to 20 degrees, then 5 degree increments for angles from 25 to 60 degrees. Heights were computed in 200 feet steps, and for each height the range computed. The computed range and the known initial angles were then used to solve the 4/3 earth height using the Equation [1]:

$$z \doteq S \sin \beta_0 + \frac{S^2}{2a_e} \qquad (15)$$

where a_e is the effective earth's radius, in this case (4/3)a. Equation (15) is noted to be an approximation formula, but

it constitutes the commonly employed approximation formula in the design of altitude-determining radars. Since this paper concerns corrections to radar observations, rather than corrections to the 4/3-earth model, the approximation is appropriate.

It will be noted that for each simultaneous computation of a complete ray through the model atmosphere and the 4/3-earth atmosphere, both rays have a common initial angle and range. The common range value for the two rays was reduced to intervals of ten miles, and the corresponding heights for each model were interpolated to proper values for the 10-mile intervals for identical values of β_0. After all rays have been computed, two sets of tables will exist for each range, one set containing a family of heights for the 4/3-earth atmosphere, and the second table containing corresponding values of the model height. The table containing the 4/3-earth model height was then reduced to 10,000 feet intervals, and the corresponding true heights were linearly interpolated to their appropriate values. The general technique can be described in general terms as two-way tabular interpolation, employing the search and logic functions of the CDC-1604 computer.[3] The results were then printed in the form displayed in Tables 1-45.

For cases where ray trapping occurred, the computer

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[3] The author has maintained a complete set of the IBM cards used in the main program, available to those interested in the precise programming techniques.

generated ranges to the point of trapping and these were placed in a range table opposite the 4/3-earth height. Heights were obtained with their corresponding 4/3-earth model heights. The actual height of any trapped ray was arbitrarily defined as the mid-point height between the surface and the top of the trapping layer. No further computations were made for any ray in the model atmosphere after it reached the level of trapping as just defined. The ray corresponding to the next increment of β_0 was then computed as outlined in Sections 3 and 4.

5. Conclusions.

Test runs of the computation scheme for a strict exponential model were in close agreement with the published results of Bauer, Mason, and Wilson, being within ± 200 feet of these results. The tables in Appendix I should therefore provide adequate accuracy for most radar uses.

At this point, the author would like to caution the reader that, while the digital computer provided results to eight decimal places, at extreme ranges and low altitudes, the tables probably do not provide accuracy to any greater degree than ± 500 feet. In order to provide greater accuracy, smaller height increments and more sophisticated integration procedures would have to be used.

The tabulated values in Appendix I should provide a valuable addition to the height-finding radars. The existence of trapping layers can be ascertained using procedures outlined in various AROWA publications [5].

This problem constituted the first computational program of any size completed on any of the CDC-1604 computers. As a result, the task was undertaken prior to the existence of an adequate subroutine library for the computer. Since the author not only had to program the primary routine, as well as all subroutines, an approach was selected to keep these subroutines to a minimum. For example, a natural logarithm subroutine and other types of interpolation subroutines could have been useful, but limited time precluded the development of such routines during this particular study.

6. Bibliography

1. Bauer, J. R., W. C. Mason, and F. A. Wilson, Radio refraction in a cool exponential atmosphere, MIT Lincoln Laboratory technical report No. 186, 27 August 1958.

2. Bean, B. R., and G. D. Thayer, Models of the atmospheric radio refractive index, Proc. IRE 47 740 1959.

3. Kerr, Donald E., Propagation of short radio waves, McGraw-Hill, 1951.

4. Schelling, J. S., C. R. Burrows, and E. B. Ferrell, Ultra short wave propogation, Proc. IRE 21 427 1933.

5. U. S. Navy Weather Research Facility, Some aids for estimating atmospheric refractive conditions, Norfolk, Va., 1958.

APPENDIX 1

Use of Tables

Upon selecting the proper table for use, based on previous knowledge of atmospheric conditions, enter the left hand column with the observed range, and enter across the top with the observed radar height, in thousands of feet. The true altitude of the target may then be read from the table.

> EXAMPLE: Assume we are using Table 1, with an observed height of 20,000 feet (20 kilofeet) and an observed range of 150 miles. The table gives: +.20612003 +02. Note that the value is listed as a fractional coefficient with any accompanying power of ten. Moving the decimal point two places to the right as indicated by the +02, the value becomes 20.612003 kilofeet, or 20,612 feet. Considering the accuracy of the computations, this would be recorded as 20,500 feet.

In the event trapping occurred, a notation[1] has been included at the bottom of the table indicating the first angle, of those angles tested, which passed through the layer without being trapped. Elevation angles less than this angle are to be treated with caution, as the height values in the table will indicate.

---

[1] Except if trapping does not occur for any initial ray angle; then no notation appears under the table.

APPENDIX 2

TABULAR RANGE-HEIGHT VALUES

Tables 1-45

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 1000 FT. THICKNESS 200 FT. N-GRADIENT 50 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET											
	10		20		30		40		50		60	
	....		....		....		....		....		....	
010	+.09997968	+02	+.19992413	+02	+.29982850	+02	+.39968999	+02				
020	+.10005385	+02	+.20006140	+02	+.30001820	+02	+.39992428	+02	+.49977599	+02	+.59958156	+02
030	+.10017375	+02	+.20028780	+02	+.30033165	+02	+.40031123	+02	+.50022906	+02	+.60008723	+02
040	+.10033315	+02	+.20059941	+02	+.30076601	+02	+.40084935	+02	+.50085487	+02	+.60078923	+02
050	+.10052382	+02	+.20098982	+02	+.30131429	+02	+.40153327	+02	+.50165431	+02	+.60168595	+02
060	+.10072780	+02	+.20145007	+02	+.30197656	+02	+.40236059	+02	+.50261809	+02	+.60277329	+02
070	+.10093050	+02	+.20197242	+02	+.30273829	+02	+.40332274	+02	+.50374568	+02	+.60404168	+02
080	+.10109722	+02	+.20254484	+02	+.30359347	+02	+.40440705	+02	+.50502456	+02	+.60549008	+02
090	+.10125785	+02	+.20315801	+02	+.30452627	+02	+.40561079	+02	+.50646519	+02	+.60711300	+02
100	+.10132445	+02	+.20376781	+02	+.30552245	+02	+.40691809	+02	+.50803443	+02	+.60891388	+02
110	+.10133688	+02	+.20440543	+02	+.30657684	+02	+.40831538	+02	+.50972717	+02	+.61085885	+02
120	+.10128315	+02	+.20493895	+02	+.30766356	+02	+.40979747	+02	+.51152849	+02	+.61294550	+02
130	+.10150382	+02	+.20544561	+02	+.30875226	+02	+.41133871	+02	+.51343066	+02	+.61516116	+02
140	+.10186057	+02	+.20590100	+02	+.30983266	+02	+.41290482	+02	+.51544210	+02	+.61747943	+02
150	+.10222544	+02	+.20612003	+02	+.31088841	+02	+.41452161	+02	+.51746188	+02	+.61990823	+02
160	+.10259806	+02	+.20624431	+02	+.31176379	+02	+.41609032	+02	+.51958206	+02	+.62244717	+02
170	+.10297815	+02	+.20626536	+02	+.31262202	+02	+.41764035	+02	+.52166037	+02	+.62498794	+02
180	+.10336466	+02	+.20672933	+02	+.31332020	+02	+.41918418	+02	+.52384438	+02	+.62766255	+02
190	+.10375689	+02	+.20751378	+02	+.31366654	+02	+.42041843	+02	+.52581914	+02	+.63023017	+02
200	+.10415377	+02	+.20830754	+02	+.31389231	+02	+.42163561	+02	+.52785624	+02	+.63290043	+02

TABLE 1

```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 1000 FT.    THICKNESS    200 FT.    N-GRADIENT         100  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
        ........            ........            ........            ........            ........            ........
010  +.09997896 +02   +.19992398 +02   +.29982820 +02   +.39969000 +02
020  +.10005062 +02   +.20006065 +02   +.30001790 +02   +.39992412 +02   +.49977593 +02   +.59958125 +02
030  +.10016547 +02   +.20028596 +02   +.30033088 +02   +.40031082 +02   +.50022882 +02   +.60000708 +02
040  +.10031537 +02   +.20059580 +02   +.30076452 +02   +.40084856 +02   +.50085439 +02   +.60078892 +02
050  +.10048905 +02   +.20098341 +02   +.30131170 +02   +.40153193 +02   +.50165350 +02   +.60168542 +02
060  +.10065695 +02   +.20143911 +02   +.30197247 +02   +.40235848 +02   +.50261681 +02   +.60277246 +02
070  +.10079120 +02   +.20195433 +02   +.30273198 +02   +.40331959 +02   +.50374378 +02   +.60404044 +02
080  +.10082952 +02   +.20251522 +02   +.30358401 +02   +.40440242 +02   +.50502182 +02   +.60548831 +02
090  +.10084956 +02   +.20311243 +02   +.30451202 +02   +.40560415 +02   +.50646141 +02   +.60711055 +02
100  +.10064518 +02   +.20368470 +02   +.30550069 +02   +.40690860 +02   +.50802921 +02   +.60891061 +02
110  +.10035819 +02   +.20428231 +02   +.30654392 +02   +.40830176 +02   +.50971998 +02   +.61085444 +02
120  +.09997735 +02   +.20467814 +02   +.30761447 +02   +.40977813 +02   +.51151855 +02   +.61293960 +02
130  +.10017084 +02   +.20502862 +02   +.30867173 +02   +.41131134 +02   +.51341692 +02   +.61515327 +02
140  +.10061562 +02   +.20528635 +02   +.30970888 +02   +.41286351 +02   +.51542375 +02   +.61746875 +02
150  +.10105648 +02   +.20511518 +02   +.31068634 +02   +.41446362 +02   +.51743537 +02   +.61989382 +02
160  +.10149551 +02   +.20482043 +02   +.31138517 +02   +.41599637 +02   +.51954554 +02   +.62242821 +02
170  +.10193412 +02   +.20439341 +02   +.31206048 +02   +.41749976 +02   +.52160648 +02   +.62496118 +02
180  +.10237262 +02   +.20474525 +02   +.31247232 +02   +.41897280 +02   +.52377232 +02   +.62762754 +02
190  +.10281133 +02   +.20562267 +02   +.31232863 +02   +.42000978 +02   +.52569782 +02   +.63017795 +02
200  +.10325011 +02   +.20650023 +02   +.31203458 +02   +.42102280 +02   +.52768472 +02   +.63283006 +02
```

TABLE 2

```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS



TRAPPING LAYER TOP 1000 FT.    THICKNESS    200 FT.    N-GRADIENT          '200  UNITS/1000 FT.


RANGE                                   4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10                 20                 30                 40                 50                 60
       .........          .........          .........          .........          .........          .........
010  +.09997752 +02     +.19992369 +02     +.29982811 +02     +.39968999 +02
020  +.10004414 +02     +.20005917 +02     +.30001730 +02     +.39992383 +02     +.49977577 +02     +.59958117 +02
030  +.10014873 +02     +.20028227 +02     +.30032935 +02     +.40031002 +02     +.50022835 +02     +.60008678 +02
040  +.49999999 -00     +.09999999 +01     +.30076154 +02     +.40084699 +02     +.50085343 +02     +.60078830 +02
050  +.39999999 -00     +.07999999 +01     +.30130650 +02     +.40152924 +02     +.50165188 +02     +.60168435 +02
060  +.33333332 -00     +.06666666 +01     +.09999999 +01     +.40235426 +02     +.50261425 +02     +.60277079 +02
070  +.28571428 -00     +.05714285 +01     +.08571428 +01     +.40331327 +02     +.50373999 +02     +.60403796 +02
080  +.24999999 -00     +.49999999 -00     +.07499999 +01     +.09999999 +01     +.50501632 +02     +.60548477 +02
090  +.22222222 -00     +.44444443 -00     +.06666666 +01     +.08888888 +01     +.50645382 +02     +.60710562 +02
100  +.19999999 -00     +.39999999 -00     +.05999999 +01     +.07999999 +01     +.50801871 +02     +.60890403 +02
110  +.18181818 -00     +.36363635 -00     +.05454545 +01     +.07272727 +01     +.09090908 +01     +.61084557 +02
120  +.16666666 -00     +.33333332 -00     +.49999999 -00     +.06666666 +01     +.08333333 +01     +.09999999 +01
130  +.15384615 -00     +.30769230 -00     +.46153845 -00     +.06153846 +01     +.07692307 +01     +.09230769 +01
140  +.14285714 -00     +.28571428 -00     +.42857142 -00     +.05714285 +01     +.07142857 +01     +.08571428 +01
150  +.13333333 -00     +.26666666 -00     +.39999999 -00     +.05333333 +01     +.06666666 +01     +.07999999 +01
160  +.12499999 -00     +.24999999 -00     +.37499999 -00     +.49999999 -00     +.06249999 +01     +.07499999 +01
170  +.11764705 -00     +.23529411 -00     +.35294117 -00     +.47058823 -00     +.05882352 +01     +.07058823 +01
180  +.11111111 -00     +.22222222 -00     +.33333332 -00     +.44444443 -00     +.05555555 +01     +.06666666 +01
190  +.10526315 -00     +.21052631 -00     +.31578947 -00     +.42105262 -00     +.05263157 +01     +.06315789 +01
200  +.35752208 -00     +.07150441 +01     +.09400393 +02     +.41942987 +02     +.52731157 +02     +.63268357 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN     .5 DEGREES
```

TABLE 3

```
               HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 1000 FT.    THICKNESS    400 FT.    N-GRADIENT          50  UNITS/1000 FT.


RANGE                               4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                20                30                40                50                60
         ........          ........          ........          ........          ........          ........
010   +.09997857 +02   +.19992390 +02   +.29982795 +02   +.39968966 +02
020   +.10004888 +02   +.20006025 +02   +.30001774 +02   +.39992404 +02   +.49977585 +02   +.59958101 +02
030   +.10016100 +02   +.20028497 +02   +.30033047 +02   +.40031061 +02   +.50022869 +02   +.60008700 +02
040   +.10030572 +02   +.20059386 +02   +.30076372 +02   +.40084814 +02   +.50085413 +02   +.60078875 +02
050   +.10047003 +02   +.20097996 +02   +.30131031 +02   +.40153121 +02   +.50165306 +02   +.60168513 +02
060   +.10061765 +02   +.20143318 +02   +.30197026 +02   +.40235735 +02   +.50261612 +02   +.60277201 +02
070   +.10071164 +02   +.20194451 +02   +.30272858 +02   +.40331790 +02   +.50374276 +02   +.60403977 +02
080   +.10067277 +02   +.20249908 +02   +.30357889 +02   +.40439993 +02   +.50502034 +02   +.60548736 +02
090   +.10060669 +02   +.20308750 +02   +.30450431 +02   +.40560056 +02   +.50645938 +02   +.60710923 +02
100   +.10021764 +02   +.20363864 +02   +.30548888 +02   +.40690347 +02   +.50802640 +02   +.60890884 +02
110   +.09972679 +02   +.20421372 +02   +.30652600 +02   +.40829440 +02   +.50971610 +02   +.61085206 +02
120   +.09912321 +02   +.20452706 +02   +.30758764 +02   +.40976765 +02   +.51151319 +02   +.61293642 +02
130   +.09929644 +02   +.20478370 +02   +.30862728 +02   +.41129649 +02   +.51340950 +02   +.61514902 +02
140   +.09979840 +02   +.20491759 +02   +.30964008 +02   +.41284099 +02   +.51541382 +02   +.61746299 +02
150   +.10028893 +02   +.20448045 +02   +.31057173 +02   +.41443191 +02   +.51742099 +02   +.61988603 +02
160   +.10077146 +02   +.20390015 +02   +.31116453 +02   +.41594448 +02   +.51952567 +02   +.62241795 +02
170   +.10124819 +02   +.20316775 +02   +.31173003 +02   +.41742164 +02   +.52157705 +02   +.62494667 +02
180   +.10172076 +02   +.20344153 +02   +.31195662 +02   +.41885364 +02   +.52373287 +02   +.62760853 +02
190   +.10218992 +02   +.20437984 +02   +.31147889 +02   +.41977225 +02   +.52563064 +02   +.63014946 +02
200   +.10265604 +02   +.20531209 +02   +.31083031 +02   +.42066277 +02   +.52758929 +02   +.63279158 +02
```

TABLE 4

```
                  HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 1000 FT.    THICKNESS    400 FT.    N-GRADIENT         100  UNITS/1000 FT.


RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
        ........            ........            ........            ........            ........            ........
010  +.09997641 +02    +.19992346 +02    +.29982804 +02    +.39968998 +02
020  +.10003916 +02    +.20005803 +02    +.30001684 +02    +.39992360 +02    +.49977564 +02    +.59958110 +02
030  +.10013586 +02    +.20027944 +02    +.30032818 +02    +.40030940 +02    +.50022798 +02    +.60008654 +02
040  +.10025106 +02    +.20058297 +02    +.30075924 +02    +.40084578 +02    +.50085270 +02    +.60078782 +02
050  +.10036109 +02    +.20096056 +02    +.30130251 +02    +.40152717 +02    +.50165063 +02    +.60168353 +02
060  +.10038660 +02    +.20139981 +02    +.30195791 +02    +.40235101 +02    +.50261229 +02    +.60276950 +02
070  +.10021104 +02    +.20188900 +02    +.30270949 +02    +.40330842 +02    +.50373707 +02    +.60403605 +02
080  +.09962881 +02    +.20240713 +02    +.30355016 +02    +.40438595 +02    +.50501209 +02    +.60548204 +02
090  +.09880573 +02    +.20294458 +02    +.30446086 +02    +.40558047 +02    +.50644799 +02    +.60710184 +02
100  +.09511465 +02    +.20336867 +02    +.30542205 +02    +.40687468 +02    +.50801064 +02    +.60889897 +02
110  +.09098046 +02    +.20380802 +02    +.30642394 +02    +.40825295 +02    +.50969436 +02    +.61083876 +02
120  +.08639585 +02    +.20354438 +02    +.30743398 +02    +.40970849 +02    +.51148305 +02    +.61291859 +02
130  +.08604573 +02    +.20314168 +02    +.30836838 +02    +.41121231 +02    +.51336770 +02    +.61512517 +02
140  +.08738461 +02    +.20192623 +02    +.30923458 +02    +.41271257 +02    +.51535783 +02    +.61743061 +02
150  +.08860283 +02    +.19670301 +02    +.30986245 +02    +.41425023 +02    +.51733960 +02    +.61984218 +02
160  +.08972437 +02    +.19098219 +02    +.30971035 +02    +.41564206 +02    +.51941282 +02    +.62236011 +02
170  +.09076663 +02    +.18475272 +02    +.30950501 +02    +.41696140 +02    +.52140883 +02    +.62486457 +02
180  +.09174330 +02    +.18348660 +02    +.30719785 +02    +.41812769 +02    +.52350644 +02    +.62750076 +02
190  +.09266469 +02    +.18532939 +02    +.30068521 +02    +.41821458 +02    +.52523735 +02    +.62998683 +02
200  +.09353915 +02    +.18707831 +02    +.29363152 +02    +.41824463 +02    +.52702604 +02    +.63257112 +02


                                              TABLE  5
```

```
                  HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 1000 FT.   THICKNESS   400 FT.   N-GRADIENT         200  UNITS/1000 FT.

RANGE                               4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10                20                30                40                50                60
       ........          ........          ........          ........          ........          ........
010  +.09997206 +02  +.19992258 +02  +.29982779 +02  +.39968994 +02
020  +.10001952 +02  +.20005356 +02  +.30001504 +02  +.39992270 +02  +.49977515 +02  +.59958084 +02
030  +.10008439 +02  +.20026832 +02  +.30032358 +02  +.40030698 +02  +.50022654 +02  +.60008564 +02
040  +.49999999 -00  +.09999999 +01  +.30075025 +02  +.40084104 +02  +.50084983 +02  +.60078594 +02
050  +.39999999 -00  +.07999999 +01  +.30128679 +02  +.40151908 +02  +.50164576 +02  +.60168031 +02
060  +.33333332 -00  +.06666666 +01  +.09999999 +01  +.40233827 +02  +.50260459 +02  +.60276449 +02
070  +.28571428 -00  +.05714285 +01  +.08571428 +01  +.40328931 +02  +.50372562 +02  +.60402858 +02
080  +.24999999 -00  +.49999999 -00  +.07499999 +01  +.09999999 +01  +.50499545 +02  +.60547136 +02
090  +.22222222 -00  +.44444443 -00  +.06666666 +01  +.08888888 +01  +.50642500 +02  +.60708697 +02
100  +.19999999 -00  +.39999999 -00  +.05999999 +01  +.07999999 +01  +.50797874 +02  +.60887907 +02
110  +.18181818 -00  +.36363635 -00  +.05454545 +01  +.07272727 +01  +.09090908 +01  +.61081189 +02
120  +.16666666 -00  +.33333332 -00  +.49999999 -00  +.06666666 +01  +.08333333 +01  +.09999999 +01
130  +.15384615 -00  +.30769230 -00  +.46153845 -00  +.06153846 +01  +.07692307 +01  +.09230769 +01
140  +.14285714 -00  +.28571428 -00  +.42857142 -00  +.05714285 +01  +.07142857 +01  +.08571428 +01
150  +.13333333 -00  +.26666666 -00  +.39999999 -00  +.05333333 +01  +.06666666 +01  +.07999999 +01
160  +.12499999 -00  +.24999999 -00  +.37499999 -00  +.49999999 -00  +.06249999 +01  +.07499999 +01
170  +.11764705 -00  +.23529411 -00  +.35294117 -00  +.47058823 -00  +.05882352 +01  +.07058823 +01
180  +.11111111 -00  +.22222222 -00  +.33333332 -00  +.44444443 -00  +.05555555 +01  +.06666666 +01
190  +.10526315 -00  +.21052631 -00  +.31578947 -00  +.42105262 -00  +.05263157 +01  +.06315789 +01
200  +.35752208 -00  +.07150441 +01  +.31887039 +02  +.42182719 +02  +.52566051 +02  +.63209103 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN   1.5 DEGREES

                                       TABLE  6
```

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 1000 FT. THICKNESS 800 FT. N-GRADIENT 50. UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997470 +02	+.19992310 +02	+.29982821 +02	+.39969031 +02		
020	+.10003148 +02	+.20005627 +02	+.30001613 +02	+.39992323 +02	+.49977547 +02	+.59958126 +02
030	+.10011594 +02	+.20027508 +02	+.30032637 +02	+.40030845 +02	+.50022741 +02	+.60008617 +02
040	+.10020749 +02	+.20057438 +02	+.30075571 +02	+.40084392 +02	+.50085157 +02	+.60078708 +02
050	+.10027347 +02	+.20094523 +02	+.30129635 +02	+.40152399 +02	+.50164871 +02	+.60168226 +02
060	+.10019722 +02	+.20137334 +02	+.30194816 +02	+.40234602 +02	+.50260927 +02	+.60276753 +02
070	+.09978353 +02	+.20184480 +02	+.30269441 +02	+.40330094 +02	+.50373258 +02	+.60403311 +02
080	+.09870919 +02	+.20233351 +02	+.30352741 +02	+.40437491 +02	+.50500557 +02	+.60547785 +02
090	+.09726221 +02	+.20282957 +02	+.30442637 +02	+.40556458 +02	+.50643900 +02	+.60709601 +02
100	+.09136663 +02	+.20314778 +02	+.30536883 +02	+.40685188 +02	+.50799819 +02	+.60889118 +02
110	+.08474992 +02	+.20347392 +02	+.30634227 +02	+.40822007 +02	+.50967717 +02	+.61082826 +02
120	+.77414673 +01	+.20268860 +02	+.30731042 +02	+.40966144 +02	+.51145920 +02	+.61290450 +02
130	+.76670399 +01	+.20168820 +02	+.30815755 +02	+.41114522 +02	+.51333456 +02	+.61510632 +02
140	+.78559273 +01	+.19942094 +02	+.30890150 +02	+.41260964 +02	+.51531337 +02	+.61740497 +02
150	+.08026155 +02	+.19088278 +02	+.30926182 +02	+.41410410 +02	+.51727477 +02	+.61980741 +02
160	+.08181118 +02	+.18157131 +02	+.30843425 +02	+.41539569 +02	+.51932265 +02	+.62231419 +02
170	+.08323494 +02	+.17147652 +02	+.30752968 +02	+.41658340 +02	+.52127375 +02	+.62479922 +02
180	+.08455376 +02	+.16910753 +02	+.30334203 +02	+.41751867 +02	+.52332406 +02	+.62741482 +02
190	+.08578404 +02	+.17156809 +02	+.29258798 +02	+.41685089 +02	+.52491583 +02	+.62985640 +02
200	+.08693863 +02	+.17387726 +02	+.28100890 +02	+.41610021 +02	+.52656283 +02	+.63239378 +02

TABLE 7

```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 1000 FT.    THICKNESS    800 FT.    N-GRADIENT          100  UNITS/1000 FT.


RANGE                                  4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10                  20                  30                  40                  50                  60
       ........            ........            ........            ........            ........            ........
010   +.09996746 +02     +.19992164 +02     +.29982751 +02     +.39968989 +02
020   +.09999999 +01     +.20004882 +02     +.30001313 +02     +.39992175 +02     +.49977462 +02     +.59958056 +02
030   +.06666666 +01     +.20025653 +02     +.30031870 +02     +.40030442 +02     +.50022502 +02     +.60008467 +02
040   +.49999999 -00     +.09999999 +01     +.30074072 +02     +.40083603 +02     +.50084679 +02     +.60078396 +02
050   +.39999999 -00     +.07999999 +01     +.30127015 +02     +.40151049 +02     +.50164059 +02     +.60167690 +02
060   +.33333332 -00     +.06666666 +01     +.09999999 +01     +.40232476 +02     +.50259644 +02     +.60275917 +02
070   +.28571428 -00     +.05714285 +01     +.08571428 +01     +.40326907 +02     +.50371348 +02     +.60402066 +02
080   +.24999999 -00     +.49999999 -00     +.07499999 +01     +.09999999 +01     +.50497783 +02     +.60546004 +02
090   +.22222222 -00     +.44444443 -00     +.06666666 +01     +.08888888 +01     +.50640066 +02     +.60707121 +02
100   +.19999999 -00     +.39999999 -00     +.05999999 +01     +.07999999 +01     +.50794498 +02     +.60885800 +02
110   +.18181818 -00     +.36363635 -00     +.05454545 +01     +.07272727 +01     +.09090908 +01     +.61078343 +02
120   +.16666666 -00     +.33333332 -00     +.49999999 -00     +.06666666 +01     +.08333333 +01     +.09999999 +01
130   +.15384615 -00     +.30769230 -00     +.46153845 -00     +.06153846 +01     +.07692307 +01     +.09230769 +01
140   +.14285714 -00     +.28571428 -00     +.42857142 -00     +.05714285 +01     +.07142857 +01     +.08571428 +01
150   +.13333333 -00     +.26666666 -00     +.39999999 -00     +.05333333 +01     +.06666666 +01     +.07999999 +01
160   +.12499999 -00     +.24999999 -00     +.37499999 -00     +.49999999 -00     +.06249999 +01     +.07499999 +01
170   +.11764705 -00     +.23529411 -00     +.35294117 -00     +.47058823 -00     +.05882352 +01     +.07058823 +01
180   +.11111111 -00     +.22222222 -00     +.33333332 -00     +.44444443 -00     +.05555555 +01     +.06666666 +01
190   +.10526315 -00     +.21052631 -00     +.31578947 -00     +.42105262 -00     +.05263157 +01     +.06315789 +01
200   +.35752208 -00     +.07150441 +01     +.08634298 +02     +.39340513 +02     +.52426349 +02     +.63158879 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN     .5 DEGREES
```

TABLE 8

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 1000 FT.    THICKNESS    800 FT.    N-GRADIENT          '200  UNITS/1000 FT.

RANGE                                     4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                   20                   30                   40                   50                   60
        ........             ........             ........             ........             ........             ........
010   +.09995291 +02    +.19991870 +02    +.29982665 +02    +.39968976 +02
020   +.09999999 +01    +.20003385 +02    +.30000712 +02    +.39991877 +02    +.49977297 +02    +.59957968 +02
030   +.06666666 +01    +.20021903 +02    +.30030330 +02    +.40029634 +02    +.50022024 +02    +.60008164 +02
040   +.49999999 -00    +.09999999 +01    +.30071046 +02    +.40082016 +02    +.50083720 +02    +.60077770 +02
050   +.39999999 -00    +.07999999 +01    +.30121696 +02    +.40148328 +02    +.50162426 +02    +.60166615 +02
060   +.33333332 -00    +.06666666 +01    +.09999999 +01    +.40228176 +02    +.50257058 +02    +.60274235 +02
070   +.28571428 -00    +.05714285 +01    +.08571428 +01    +.40320428 +02    +.50367490 +02    +.60399556 +02
080   +.24999999 -00    +.49999999 -00    +.07499999 +01    +.09999999 +01    +.50492154 +02    +.60542407 +02
090   +.22222222 -00    +.44444443 -00    +.06666666 +01    +.08888888 +01    +.50632254 +02    +.60702098 +02
100   +.19999999 -00    +.39999999 -00    +.05999999 +01    +.07999999 +01    +.50783593 +02    +.60879056 +02
110   +.18181818 -00    +.36363635 -00    +.05454545 +01    +.07272727 +01    +.09090908 +01    +.61069194 +02
120   +.16666666 -00    +.33333332 -00    +.49999999 -00    +.06666666 +01    +.08333333 +01    +.09999999 +01
130   +.15384615 -00    +.30769230 -00    +.46153845 -00    +.06153846 +01    +.07692307 +01    +.09230769 +01
140   +.14285714 -00    +.28571428 -00    +.42857142 -00    +.05714285 +01    +.07142857 +01    +.08571428 +01
150   +.13333333 -00    +.26666666 -00    +.39999999 -00    +.05333333 +01    +.06666666 +01    +.07999999 +01
160   +.12499999 -00    +.24999999 -00    +.37499999 -00    +.49999999 -00    +.06249999 +01    +.07499999 +01
170   +.11764705 -00    +.23529411 -00    +.35294117 -00    +.47058823 -00    +.05882352 +01    +.07058823 +01
180   +.11111111 -00    +.22222222 -00    +.33333332 -00    +.44444443 -00    +.05555555 +01    +.06666666 +01
190   +.10526315 -00    +.21052631 -00    +.31578947 -00    +.42105262 -00    +.05263157 +01    +.06315789 +01
200   +.35752208 -00    +.07150441 +01    +.31165284 +02    +.41220379 +02    +.51608139 +02    +.62963404 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN    1.5 DEGREES
```

TABLE 9

```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 2000 FT.    THICKNESS    200 FT.    N-GRADIENT          '50  UNITS/1000 FT.


RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES       10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010   +.09997968 +02    +.19992413 +02    +.29982828 +02    +.39968954 +02
020   +.10005386 +02    +.20006139 +02    +.30001820 +02    +.39992428 +02    +.49977593 +02    +.59958133 +02
030   +.10017394 +02    +.20028780 +02    +.30033164 +02    +.40031122 +02    +.50022906 +02    +.60008724 +02
040   +.10033404 +02    +.20059943 +02    +.30076601 +02    +.40084934 +02    +.50085486 +02    +.60078923 +02
050   +.10052686 +02    +.20098991 +02    +.30131430 +02    +.40153327 +02    +.50165430 +02    +.60168595 +02
060   +.10073846 +02    +.20145038 +02    +.30197659 +02    +.40236059 +02    +.50261808 +02    +.60277328 +02
070   +.10096213 +02    +.20197324 +02    +.30273837 +02    +.40332275 +02    +.50374567 +02    +.60404167 +02
080   +.10117441 +02    +.20254688 +02    +.30359367 +02    +.40440709 +02    +.50502457 +02    +.60549007 +02
090   +.10138571 +02    +.20316208 +02    +.30452672 +02    +.40561087 +02    +.50646520 +02    +.60711300 +02
100   +.10156210 +02    +.20377973 +02    +.30552348 +02    +.40691827 +02    +.50803448 +02    +.60891389 +02
110   +.10169517 +02    +.20442582 +02    +.30657904 +02    +.40831576 +02    +.50972726 +02    +.61085887 +02
120   +.10177286 +02    +.20500709 +02    +.30766778 +02    +.40979823 +02    +.51152868 +02    +.61294556 +02
130   +.10200590 +02    +.20556852 +02    +.30876253 +02    +.41134010 +02    +.51343102 +02    +.61516126 +02
140   +.10232952 +02    +.20609651 +02    +.30985202 +02    +.41290782 +02    +.51544271 +02    +.61747963 +02
150   +.10266560 +02    +.20647251 +02    +.31093072 +02    +.41452668 +02    +.51746313 +02    +.61990861 +02
160   +.10301317 +02    +.20676504 +02    +.31186793 +02    +.41610245 +02    +.51958426 +02    +.62244778 +02
170   +.10337099 +02    +.20696545 +02    +.31279001 +02    +.41766224 +02    +.52166471 +02    +.62498914 +02
180   +.10373797 +02    +.20747594 +02    +.31359680 +02    +.41922522 +02    +.52385106 +02    +.62766439 +02
190   +.10411264 +02    +.20822528 +02    +.31413973 +02    +.42052839 +02    +.52583611 +02    +.63023410 +02
200   +.10449372 +02    +.20898745 +02    +.31457386 +02    +.42181677 +02    +.52788367 +02    +.63290658 +02
```

TABLE 10

```
               HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 2000 FT.    THICKNESS    200 FT.    N-GRADIENT          .100  UNITS/1000 FT.


RANGE                                       4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10                  20                  30                  40                  50                  60
       ........            ........            ........            ........            ........            ........
010  +.09997896  +02   +.19992398  +02   +.29982819  +02   +.39969000  +02
020  +.10005069  +02   +.20006065  +02   +.30001790  +02   +.39992412  +02   +.49977593  +02   +.59958125  +02
030  +.10016599  +02   +.20028598  +02   +.30033038  +02   +.40031082  +02   +.50022882  +02   +.60008708  +02
040  +.10031762  +02   +.20059588  +02   +.30076453  +02   +.40084856  +02   +.50085439  +02   +.60078892  +02
050  +.10049652  +02   +.20098369  +02   +.30131174  +02   +.40153194  +02   +.50165350  +02   +.60168542  +02
060  +.10068306  +02   +.20143993  +02   +.30197257  +02   +.40235850  +02   +.50261681  +02   +.60277246  +02
070  +.10087096  +02   +.20195641  +02   +.30273223  +02   +.40331964  +02   +.50374380  +02   +.60404044  +02
080  +.10102781  +02   +.20252030  +02   +.30358456  +02   +.40440255  +02   +.50507186  +02   +.60548832  +02
090  +.10118315  +02   +.20312243  +02   +.30451320  +02   +.40560441  +02   +.50646149  +02   +.60711058  +02
100  +.10131164  +02   +.20371390  +02   +.30550329  +02   +.40690912  +02   +.50802937  +02   +.60891066  +02
110  +.10139012  +02   +.20433223  +02   +.30654938  +02   +.40830280  +02   +.50972027  +02   +.61085454  +02
120  +.10140698  +02   +.20485204  +02   +.30762485  +02   +.40978008  +02   +.51151909  +02   +.61293979  +02
130  +.10164124  +02   +.20534491  +02   +.30869689  +02   +.41131485  +02   +.51341791  +02   +.61515360  +02
140  +.10198897  +02   +.20580229  +02   +.30975631  +02   +.41287095  +02   +.51542536  +02   +.61746934  +02
150  +.10234596  +02   +.20610698  +02   +.31079238  +02   +.41447608  +02   +.51743854  +02   +.61989484  +02
160  +.10271173  +02   +.20632198  +02   +.31165187  +02   +.41602608  +02   +.51955102  +02   +.62242982  +02
170  +.10308573  +02   +.20643893  +02   +.31249324  +02   +.41755336  +02   +.52161717  +02   +.62496424  +02
180  +.10346686  +02   +.20693373  +02   +.31321561  +02   +.41907492  +02   +.52378869  +02   +.62763218  +02
190  +.10385431  +02   +.20770863  +02   +.31366808  +02   +.42029106  +02   +.52573939  +02   +.63018766  +02
200  +.10424687  +02   +.20849375  +02   +.31400551  +02   +.42148918  +02   +.52775191  +02   +.63284518  +02
```

TABLE 11

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 2000 FT. THICKNESS 200 FT. N-GRADIENT 200 UNITS/1000 FT.

RANGE IN MILES	4/3 EARTH HEIGHT IN KILOFEET 10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997752 +02	+.19992369 +02	+.29982811 +02	+.39968999 +02		
020	+.10004432 +02	+.20005918 +02	+.30001730 +02	+.39992383 +02	+.49977577 +02	+.59958116 +02
030	+.10014992 +02	+.20028233 +02	+.30032936 +02	+.40031002 +02	+.50022835 +02	+.60008678 +02
040	+.10028407 +02	+.20058876 +02	+.30076157 +02	+.40084700 +02	+.50085344 +02	+.60078830 +02
050	+.10043357 +02	+.20097116 +02	+.30130661 +02	+.40152927 +02	+.50165188 +02	+.60168435 +02
060	+.10056495 +02	+.20141875 +02	+.30196450 +02	+.40235432 +02	+.50261428 +02	+.60277079 +02
070	+.10063876 +02	+.20192208 +02	+.30271987 +02	+.40331342 +02	+.50374004 +02	+.60403798 +02
080	+.10068832 +02	+.20246556 +02	+.30356615 +02	+.40439343 +02	+.50501643 +02	+.60548481 +02
090	+.10070354 +02	+.20304011 +02	+.30448579 +02	+.40559139 +02	+.50645403 +02	+.60710571 +02
100	+.10068779 +02	+.20357397 +02	+.30546209 +02	+.40689063 +02	+.50801909 +02	+.60890418 +02
110	+.10060343 +02	+.20413111 +02	+.30648840 +02	+.40827652 +02	+.50970618 +02	+.61084584 +02
120	+.10044008 +02	+.20450019 +02	+.30753586 +02	+.40974317 +02	+.51149973 +02	+.61292818 +02
130	+.10067195 +02	+.20482405 +02	+.30855842 +02	+.41126324 +02	+.51339135 +02	+.61513816 +02
140	+.10108264 +02	+.20510183 +02	+.30955158 +02	+.41279495 +02	+.51539012 +02	+.61744854 +02
150	+.10149598 +02	+.20519383 +02	+.31048847 +02	+.41437113 +02	+.51738837 +02	+.61986696 +02
160	+.10191015 +02	+.20517858 +02	+.31115658 +02	+.41586483 +02	+.51948285 +02	+.62239337 +02
170	+.10232664 +02	+.20504768 +02	+.31179923 +02	+.41732060 +02	+.52151887 +02	+.62491347 +02
180	+.10274372 +02	+.20549144 +02	+.31229870 +02	+.41874738 +02	+.52365905 +02	+.62756629 +02
190	+.10316699 +02	+.20633399 +02	+.31248208 +02	+.41974935 +02	+.52553414 +02	+.63009180 +02
200	+.10359001 +02	+.20718003 +02	+.31253267 +02	+.42072542 +02	+.52746954 +02	+.63271781 +02

TRAPPING OCCURS FOR ALL ANGLES LESS THAN 0 DEGREES

TABLE 12

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 2000 FT. THICKNESS 400 FT. N-GRADIENT 50 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10	 20	 30	 40	 50	 60 ....
010	+.09997856 +02	+.19992390 +02	+.29982833 +02	+.39969033 +02		
020	+.10004893 +02	+.20006024 +02	+.30001774 +02	+.39992405 +02	+.49977582 +02	+.59958139 +02
030	+.10016156 +02	+.20028497 +02	+.30033046 +02	+.40031060 +02	+.50022869 +02	+.60008700 +02
040	+.10030843 +02	+.20059392 +02	+.30076371 +02	+.40084813 +02	+.50085412 +02	+.60078875 +02
050	+.10047942 +02	+.20098024 +02	+.30131032 +02	+.40153120 +02	+.50165305 +02	+.60168512 +02
060	+.10065159 +02	+.20143410 +02	+.30197034 +02	+.40235735 +02	+.50261611 +02	+.60277199 +02
070	+.10081833 +02	+.20194699 +02	+.30272882 +02	+.40331792 +02	+.50374276 +02	+.60403976 +02
080	+.10094172 +02	+.20250537 +02	+.30357948 +02	+.40440003 +02	+.50502036 +02	+.60548735 +02
090	+.10106632 +02	+.20310008 +02	+.30450566 +02	+.40560082 +02	+.50645943 +02	+.60710923 +02
100	+.10116142 +02	+.20367645 +02	+.30549200 +02	+.40690403 +02	+.50802653 +02	+.60890887 +02
110	+.10120537 +02	+.20427875 +02	+.30653274 +02	+.40829557 +02	+.50971638 +02	+.61085214 +02
120	+.10118370 +02	+.20476172 +02	+.30760068 +02	+.40976995 +02	+.51151376 +02	+.61293658 +02
130	+.10141843 +02	+.20521341 +02	+.30865967 +02	+.41130071 +02	+.51341060 +02	+.61514934 +02
140	+.10178083 +02	+.20562809 +02	+.30970172 +02	+.41285024 +02	+.51541567 +02	+.61746360 +02
150	+.10215050 +02	+.20598757 +02	+.31071271 +02	+.41444758 +02	+.51742479 +02	+.61988717 +02
160	+.10252751 +02	+.20605359 +02	+.31152557 +02	+.41598276 +02	+.51953239 +02	+.62241980 +02
170	+.10291134 +02	+.20611772 +02	+.31231847 +02	+.41749127 +02	+.52159043 +02	+.62495032 +02
180	+.10320110 +02	+.20660239 +02	+.31298929 +02	+.41898861 +02	+.52375353 +02	+.62761414 +02
190	+.10369637 +02	+.20739275 +02	+.31338443 +02	+.42015252 +02	+.52568441 +02	+.63016155 +02
200	+.10409597 +02	+.20819194 +02	+.31366076 +02	+.42129647 +02	+.52767670 +02	+.63281059 +02

TABLE 13

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 2000 FT. THICKNESS 400 FT. N-GRADIENT 100 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997641 +02	+.19992346 +02	+.29982804 +02	+.39968997 +02		
020	+.10003937 +02	+.20005803 +02	+.30001684 +02	+.39992359 +02	+.49977564 +02	+.59958110 +02
030	+.10013743 +02	+.20027949 +02	+.30032818 +02	+.40030939 +02	+.50022798 +02	+.60008654 +02
040	+.10025801 +02	+.20058323 +02	+.30075927 +02	+.40084578 +02	+.50085270 +02	+.60078781 +02
050	+.10038470 +02	+.20096141 +02	+.30130262 +02	+.40152719 +02	+.50165063 +02	+.60168352 +02
060	+.10047340 +02	+.20140230 +02	+.30195823 +02	+.40235108 +02	+.50261230 +02	+.60276950 +02
070	+.10051261 +02	+.20189541 +02	+.30271026 +02	+.40330859 +02	+.50373711 +02	+.60403606 +02
080	+.10042732 +02	+.20242305 +02	+.30355184 +02	+.40438634 +02	+.50501221 +02	+.60548208 +02
090	+.10033597 +02	+.20297619 +02	+.30446448 +02	+.40558127 +02	+.50644823 +02	+.60710193 +02
100	+.10021429 +02	+.20346547 +02	+.30543009 +02	+.40687627 +02	+.50801111 +02	+.60889914 +02
110	+.10001014 +02	+.20397524 +02	+.30644103 +02	+.40825611 +02	+.50969524 +02	+.61083907 +02
120	+.09971381 +02	+.20422916 +02	+.30746676 +02	+.40971449 +02	+.51148469 +02	+.61291915 +02
130	+.09994407 +02	+.20442364 +02	+.30845099 +02	+.41122314 +02	+.51337072 +02	+.61512616 +02
140	+.10040372 +02	+.20456505 +02	+.30939286 +02	+.41273592 +02	+.51536274 +02	+.61743238 +02
150	+.10085747 +02	+.20450024 +02	+.31025345 +02	+.41428963 +02	+.51734939 +02	+.61984529 +02
160	+.10130783 +02	+.20431493 +02	+.31077516 +02	+.41573973 +02	+.51942989 +02	+.62236504 +02
170	+.10175635 +02	+.20400114 +02	+.31126589 +02	+.41714017 +02	+.52144254 +02	+.62487403 +02
180	+.10220371 +02	+.20440742 +02	+.31159712 +02	+.41849386 +02	+.52355839 +02	+.62751510 +02
190	+.10265032 +02	+.20530064 +02	+.31158184 +02	+.41933201 +02	+.52537495 +02	+.63001736 +02
200	+.10309619 +02	+.20619239 +02	+.31142043 +02	+.42013823 +02	+.52725064 +02	+.63261891 +02

TABLE 14

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 2000 FT. THICKNESS 400 FT. N-GRADIENT 200 UNITS/1,000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10		20		30		40		50		60	
	....		....		....		....		....		....	
010	+.09997208	+02	+.19992258	+02	+.29982779	+02	+.39968994	+02				
020	+.10002007	+02	+.20005358	+02	+.30001504	+02	+.39992270	+02	+.49977515	+02	+.59958084	+02
030	+.10008806	+02	+.20026848	+02	+.30032360	+02	+.40030698	+02	+.50022654	+02	+.60008563	+02
040	+.10015260	+02	+.20056164	+02	+.30075035	+02	+.40084106	+02	+.50084984	+02	+.60078594	+02
050	+.10018016	+02	+.20092315	+02	+.30128712	+02	+.40151915	+02	+.50164578	+02	+.60168032	+02
060	+.06666333	+01	+.13332666	+01	+.19998999	+01	+.40233847	+02	+.50260466	+02	+.60276451	+02
070	+.05714000	+01	+.11427999	+01	+.17141999	+01	+.40328976	+02	+.50372577	+02	+.60402864	+02
080	+.49997500	-00	+.09999499	+01	+.14999249	+01	+.19998999	+01	+.50499579	+02	+.60547149	+02
090	+.44442222	-00	+.08888444	+01	+.13332666	+01	+.17776888	+01	+.50642562	+02	+.60708723	+02
100	+.39998000	-00	+.07999600	+01	+.11999400	+01	+.15999200	+01	+.50797989	+02	+.60887952	+02
110	+.36361818	-00	+.07272363	+01	+.10908545	+01	+.14544727	+01	+.18180909	+01	+.61081269	+02
120	+.33331666	-00	+.06666333	+01	+.09999499	+01	+.13332666	+01	+.16665833	+01	+.19998999	+01
130	+.30767692	-00	+.06153538	+01	+.09230307	+01	+.12307076	+01	+.15383846	+01	+.18460615	+01
140	+.28570000	-00	+.05714000	+01	+.08570999	+01	+.11428000	+01	+.14284999	+01	+.17141999	+01
150	+.26665333	-00	+.05333066	+01	+.07999600	+01	+.10666133	+01	+.13332666	+01	+.15999200	+01
160	+.24998750	-00	+.49997500	-00	+.07499625	+01	+.09999499	+01	+.12499375	+01	+.14999249	+01
170	+.23528235	-00	+.47056470	-00	+.07058470	+01	+.09411294	+01	+.11764117	+01	+.14116941	+01
180	+.22221111	-00	+.44442222	-00	+.06666333	+01	+.08888444	+01	+.11110555	+01	+.13332666	+01
190	+.21051578	-00	+.42103157	-00	+.06315473	+01	+.08420631	+01	+.10525789	+01	+.12630947	+01
200	+.07150084	+01	+.14300168	+01	+.10102700	+02	+.41663746	+02	+.52625688	+02	+.63220493	+02

TRAPPING OCCURS FOR ALL ANGLES LESS THAN .5 DEGREES

TABLE 15

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 2000 FT.   THICKNESS   800 FT.   N-GRADIENT   .50 UNITS/1000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10	20	30	40	50	60 ....
010	+.09997466 +02	+.19992310 +02	+.29982816 +02	+.39969017 +02		
020	+.10003163 +02	+.20005623 +02	+.30001611 +02	+.39992323 +02	+.49977548 +02	+.59958121 +02
030	+.10011783 +02	+.20027506 +02	+.30032633 +02	+.40030842 +02	+.50022740 +02	+.60008617 +02
040	+.10021682 +02	+.20057458 +02	+.30075568 +02	+.40084388 +02	+.50085154 +02	+.60078706 +02
050	+.10030669 +02	+.20094615 +02	+.30129640 +02	+.40152395 +02	+.50164867 +02	+.60168223 +02
060	+.10032459 +02	+.20137644 +02	+.30194842 +02	+.40234601 +02	+.50260923 +02	+.60276749 +02
070	+.10025213 +02	+.20185331 +02	+.30269521 +02	+.40330103 +02	+.50373255 +02	+.60403307 +02
080	+.09998008 +02	+.20235553 +02	+.30352939 +02	+.40437525 +02	+.50500562 +02	+.60547782 +02
090	+.09969755 +02	+.20287412 +02	+.30443097 +02	+.40556542 +02	+.50643916 +02	+.60709602 +02
100	+.09936582 +02	+.20328946 +02	+.30537954 +02	+.40685374 +02	+.50799861 +02	+.60889126 +02
110	+.09892476 +02	+.20372062 +02	+.30636584 +02	+.40822401 +02	+.50967809 +02	+.61082850 +02
120	+.09836611 +02	+.20377035 +02	+.30735651 +02	+.40966928 +02	+.51146110 +02	+.61290504 +02
130	+.09858204 +02	+.20373497 +02	+.30827756 +02	+.41115976 +02	+.51333829 +02	+.61510737 +02
140	+.09913734 +02	+.20362867 +02	+.30913434 +02	+.41264208 +02	+.51531965 +02	+.61740704 +02
150	+.09966786 +02	+.20325379 +02	+.30986379 +02	+.41415954 +02	+.51728783 +02	+.61981126 +02
160	+.10018528 +02	+.20273265 +02	+.31012533 +02	+.41553767 +02	+.51934598 +02	+.62232048 +02
170	+.10069303 +02	+.20205757 +02	+.31034614 +02	+.41684633 +02	+.52132093 +02	+.62481177 +02
180	+.10119302 +02	+.20238604 +02	+.31036519 +02	+.41807576 +02	+.52339749 +02	+.62743414 +02
190	+.10168672 +02	+.20337345 +02	+.30995706 +02	+.41862277 +02	+.52511697 +02	+.62989893 +02
200	+.10217500 +02	+.20435000 +02	+.30937677 +02	+.41912719 +02	+.52689367 +02	+.63246104 +02

TABLE 16

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                 HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS



TRAPPING LAYER TOP 2000 FT.    THICKNESS    800 FT.    N-GRADIENT         100  UNITS/1000 FT.


RANGE                                  4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                 20                 30                 40                 50                 60
         ........           ........           ........           ........           ........           ........
010   +.09996745 +02     +.19992163 +02     +.29982751 +02     +.39968990 +02
020   +.09999944 +02     +.20004882 +02     +.30001312 +02     +.39992174 +02     +.49977462 +02     +.59958055 +02
030   +.10003539 +02     +.20025670 +02     +.30031870 +02     +.40030440 +02     +.50022501 +02     +.60008466 +02
040   +.10004048 +02     +.20053856 +02     +.30074081 +02     +.40083602 +02     +.50084677 +02     +.60078394 +02
050   +.09996373 +02     +.20088228 +02     +.30127053 +02     +.40151055 +02     +.50164058 +02     +.60167689 +02
060   +.09963351 +02     +.20126735 +02     +.30190757 +02     +.40232498 +02     +.50259648 +02     +.60275916 +02
070   +.09890893 +02     +.20167370 +02     +.30263231 +02     +.40326963 +02     +.50371364 +02     +.60402069 +02
080   +.09742144 +02     +.20206255 +02     +.30343511 +02     +.40432904 +02     +.50497824 +02     +.60546016 +02
090   +.09573644 +02     +.20242465 +02     +.30428924 +02     +.40549917 +02     +.50640146 +02     +.60707151 +02
100   +.09190775 +02     +.20247702 +02     +.30516356 +02     +.40675917 +02     +.50794654 +02     +.60885855 +02
110   +.08756258 +02     +.20252137 +02     +.30604019 +02     +.40808855 +02     +.50960642 +02     +.61078448 +02
120   +.08270515 +02     +.20126126 +02     +.30687220 +02     +.40947714 +02     +.51136210 +02     +.61284614 +02
130   +.08244051 +02     +.19973718 +02     +.30748829 +02     +.41088831 +02     +.51320158 +02     +.61502878 +02
140   +.08399562 +02     +.19751288 +02     +.30792655 +02     +.41223383 +02     +.51513719 +02     +.61730069 +02
150   +.08540331 +02     +.19198416 +02     +.30790492 +02     +.41358745 +02     +.51702478 +02     +.61966778 +02
160   +.08669197 +02     +.18590120 +02     +.30648159 +02     +.41461678 +02     +.51898420 +02     +.62213190 +02
170   +.08788279 +02     +.17925707 +02     +.30495550 +02     +.41547417 +02     +.52078882 +02     +.62454611 +02
180   +.08899263 +02     +.17798526 +02     +.30162175 +02     +.41602204 +02     +.52268715 +02     +.62708697 +02
190   +.09003400 +02     +.18006800 +02     +.29467546 +02     +.41468421 +02     +.52392954 +02     +.62938271 +02
200   +.09101716 +02     +.18203433 +02     +.28713590 +02     +.41323620 +02     +.52522003 +02     +.63176676 +02
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TABLE 17

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                 HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 2000 FT.    THICKNESS    800 FT.    N-GRADIENT          200  UNITS/1000 FT.


RANGE                                 4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                 20                 30                 40                 50                 60
        .........          .........          .........          .........          .........          .........
010  +.09995297 +02   +.19991870 +02   +.29982664 +02   +.39968977 +02
020  +.09993383 +02   +.20003391 +02   +.30000711 +02   +.39991876 +02   +.49977296 +02   +.59957968 +02
030  +.09986268 +02   +.20021956 +02   +.30030336 +02   +.40029634 +02   +.50022023 +02   +.60008163 +02
040  +.09965299 +02   +.20046509 +02   +.30071079 +02   +.40082023 +02   +.50083721 +02   +.60077769 +02
050  +.07999600 +01   +.15999200 +01   +.30121805 +02   +.40148353 +02   +.50162432 +02   +.60166617 +02
060  +.06666333 +01   +.13332666 +01   +.19998999 +01   +.40228243 +02   +.50257080 +02   +.60274242 +02
070  +.05714000 +01   +.11427999 +01   +.17141999 +01   +.40320580 +02   +.50367542 +02   +.60399576 +02
080  +.49997500 -00   +.09999499 +01   +.14999249 +01   +.19998999 +01   +.50492268 +02   +.60542450 +02
090  +.44442222 -00   +.08888444 +01   +.13332666 +01   +.17776888 +01   +.50632464 +02   +.60702186 +02
100  +.39998000 -00   +.07999600 +01   +.11999400 +01   +.15999200 +01   +.50783987 +02   +.60879208 +02
110  +.36361818 -00   +.07272363 +01   +.10908545 +01   +.14544727 +01   +.18180909 +01   +.61069466 +02
120  +.33331666 -00   +.06666333 +01   +.09999499 +01   +.13332666 +01   +.16665833 +01   +.19998999 +01
130  +.30767692 -00   +.06153538 +01   +.09230307 +01   +.12307076 +01   +.15383846 +01   +.18460615 +01
140  +.28570000 -00   +.05714000 +01   +.08570999 +01   +.11428000 +01   +.14284999 +01   +.17141999 +01
150  +.26665333 -00   +.05333066 +01   +.07999600 +01   +.10666133 +01   +.13332666 +01   +.15999200 +01
160  +.24998750 -00   +.49997500 -00   +.07499625 +01   +.09999499 +01   +.12499375 +01   +.14999249 +01
170  +.23528235 -00   +.47056470 -00   +.07058470 +01   +.09411294 +01   +.11764117 +01   +.14116941 +01
180  +.22221111 -00   +.44442222 -00   +.06666333 +01   +.08888444 +01   +.11110555 +01   +.13332666 +01
190  +.21051578 -00   +.42103157 -00   +.06315473 +01   +.08420631 +01   +.10525789 +01   +.12630947 +01
200  +.07150084 +01   +.14300168 +01   +.31855728 +02   +.41807670 +02   +.52017950 +02   +.63011651 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN    1.5 DEGREES
```

TABLE 18

```
                        HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 3000 FT.    THICKNESS    200 FT.    N-GRADIENT           .50  UNITS/1000 FT.


RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010   +.09997967 +02      +.19992413 +02      +.29962847 +02      +.39968975 +02
020   +.10005388 +02      +.20006139 +02      +.30001820 +02      +.39992428 +02      +.49977594 +02      +.59958152 +02
030   +.10017412 +02      +.20028780 +02      +.30033164 +02      +.40031122 +02      +.50022906 +02      +.60008724 +02
040   +.10033484 +02      +.20059945 +02      +.30076601 +02      +.40084934 +02      +.50085486 +02      +.60078923 +02
050   +.10052936 +02      +.20099000 +02      +.30131430 +02      +.40153326 +02      +.50165430 +02      +.60168594 +02
060   +.10074581 +02      +.20145066 +02      +.30197661 +02      +.40236059 +02      +.50261808 +02      +.60277328 +02
070   +.10097872 +02      +.20197398 +02      +.30273845 +02      +.40332276 +02      +.50374567 +02      +.60404167 +02
080   +.10120821 +02      +.20254862 +02      +.30359386 +02      +.40440712 +02      +.50502457 +02      +.60549007 +02
090   +.10143698 +02      +.20316541 +02      +.30452714 +02      +.40561096 +02      +.50646522 +02      +.60711301 +02
100   +.10163229 +02      +.20378806 +02      +.30552440 +02      +.40691845 +02      +.50803452 +02      +.60891390 +02
110   +.10178652 +02      +.20443952 +02      +.30658092 +02      +.40831613 +02      +.50972735 +02      +.61085890 +02
120   +.10188754 +02      +.20503918 +02      +.30767124 +02      +.40979892 +02      +.51152886 +02      +.61294561 +02
130   +.10212143 +02      +.20562146 +02      +.30876996 +02      +.41134134 +02      +.51343137 +02      +.61516137 +02
140   +.10243735 +02      +.20617180 +02      +.30986523 +02      +.41291036 +02      +.51544329 +02      +.61747983 +02
150   +.10276680 +02      +.20657538 +02      +.31095436 +02      +.41453084 +02      +.51746425 +02      +.61990897 +02
160   +.10310860 +02      +.20689770 +02      +.31191514 +02      +.41611119 +02      +.51958617 +02      +.62244836 +02
170   +.10346132 +02      +.20713005 +02      +.31286158 +02      +.41767718 +02      +.52166831 +02      +.62499023 +02
180   +.10382379 +02      +.20764759 +02      +.31369632 +02      +.41924958 +02      +.52385645 +02      +.62766604 +02
190   +.10419441 +02      +.20838883 +02      +.31427402 +02      +.42057903 +02      +.52584805 +02      +.63023739 +02
200   +.10457186 +02      +.20914373 +02      +.31474516 +02      +.42189461 +02      +.52790227 +02      +.63291162 +02
```

TABLE 19

```
                     HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 3000 FT.    THICKNESS    200 FT.    N-GRADIENT          100  UNITS/1000 FT.


RANGE                               4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10                 20                 30                 40                 50                 60
       ........           ........           ........           ........           ........           ........
010  +.09997896 +02  +.19992398 +02  +.29982819 +02  +.39969000 +02
020  +.10005076 +02  +.20006065 +02  +.30001790 +02  +.39992412 +02  +.49977593 +02  +.59958125 +02
030  +.10016648 +02  +.20028600 +02  +.30033088 +02  +.40031082 +02  +.50022882 +02  +.60008708 +02
040  +.10031963 +02  +.20059597 +02  +.30076454 +02  +.40084856 +02  +.50085439 +02  +.60078892 +02
050  +.10050260 +02  +.20098397 +02  +.30131178 +02  +.40153194 +02  +.50165350 +02  +.60168542 +02
060  +.10070088 +02  +.20144069 +02  +.30197268 +02  +.40235853 +02  +.50261682 +02  +.60277246 +02
070  +.10091162 +02  +.20195828 +02  +.30273248 +02  +.40331970 +02  +.50374381 +02  +.60404045 +02
080  +.10111144 +02  +.20252458 +02  +.30358509 +02  +.40440268 +02  +.50502190 +02  +.60548834 +02
090  +.10131061 +02  +.20313054 +02  +.30451431 +02  +.40560467 +02  +.50646157 +02  +.60711061 +02
100  +.10148887 +02  +.20373411 +02  +.30550562 +02  +.40690962 +02  +.50802952 +02  +.60891072 +02
110  +.10162295 +02  +.20436543 +02  +.30655402 +02  +.40830377 +02  +.50972055 +02  +.61085465 +02
120  +.10170103 +02  +.20493114 +02  +.30763332 +02  +.40978187 +02  +.51151961 +02  +.61293997 +02
130  +.10193776 +02  +.20547606 +02  +.30871494 +02  +.41131796 +02  +.51341884 +02  +.61515392 +02
140  +.10226591 +02  +.20598985 +02  +.30978834 +02  +.41287718 +02  +.51542685 +02  +.61746990 +02
150  +.10260590 +02  +.20636702 +02  +.31085015 +02  +.41448623 +02  +.51744138 +02  +.61989580 +02
160  +.10295686 +02  +.20666023 +02  +.31176844 +02  +.41604732 +02  +.51955577 +02  +.62243132 +02
170  +.10331771 +02  +.20686095 +02  +.31267068 +02  +.41758960 +02  +.52162599 +02  +.62496700 +02
180  +.10368734 +02  +.20737468 +02  +.31346436 +02  +.41913427 +02  +.52380184 +02  +.62760629 +02
190  +.10406439 +02  +.20812879 +02  +.31400816 +02  +.42041606 +02  +.52576839 +02  +.63019574 +02
200  +.10444762 +02  +.20889525 +02  +.31444277 +02  +.42168208 +02  +.52779700 +02  +.63275748 +02
```

TABLE 20

```
                 HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 3000 FT.    THICKNESS    200 FT.    N-GRADIENT          200  UNITS/1000 FT.


RANGE                              4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                20                30                40                50                60
       ........          ........          ........          ........          ........          ........
010  +.09997753 +02  +.19992369 +02  +.29982811 +02  +.39968999 +02
020  +.10004450 +02  +.20005918 +02  +.30001730 +02  +.39992383 +02  +.49977577 +02  +.59958116 +02
030  +.10015105 +02  +.20028233 +02  +.30032937 +02  +.40031002 +02  +.50022635 +02  +.60008678 +02
040  +.10023857 +02  +.20058897 +02  +.30076160 +02  +.40084700 +02  +.50085344 +02  +.60078830 +02
050  +.10044727 +02  +.20097180 +02  +.30130672 +02  +.40152929 +02  +.50165189 +02  +.60168435 +02
060  +.10060602 +02  +.20142049 +02  +.30195476 +02  +.40235739 +02  +.50261430 +02  +.60277080 +02
070  +.10076664 +02  +.20192628 +02  +.30272045 +02  +.40331357 +02  +.50374009 +02  +.60403800 +02
080  +.10089674 +02  +.20247520 +02  +.30356736 +02  +.40439374 +02  +.50501654 +02  +.60548485 +02
090  +.10102623 +02  +.20305838 +02  +.30448829 +02  +.40559200 +02  +.50645423 +02  +.60710560 +02
100  +.10116021 +02  +.20362048 +02  +.30546733 +02  +.40688180 +02  +.50801946 +02  +.60890432 +02
110  +.10124255 +02  +.20420795 +02  +.30649883 +02  +.40827973 +02  +.50970685 +02  +.61034610 +02
120  +.10126207 +02  +.20469456 +02  +.30755493 +02  +.40974719 +02  +.51150093 +02  +.61292862 +02
130  +.10150438 +02  +.20515214 +02  +.30859975 +02  +.41127024 +02  +.51339347 +02  +.61513891 +02
140  +.10186109 +02  +.20557965 +02  +.30962554 +02  +.41280895 +02  +.51539349 +02  +.61744933 +02
150  +.10222593 +02  +.20588895 +02  +.31062612 +02  +.41439397 +02  +.51739475 +02  +.61986915 +02
160  +.10259853 +02  +.20610775 +02  +.31144525 +02  +.41591348 +02  +.51949351 +02  +.62239677 +02
170  +.10297859 +02  +.20622781 +02  +.31224418 +02  +.41740427 +02  +.52153870 +02  +.62491968 +02
180  +.10336508 +02  +.20673016 +02  +.31293960 +02  +.41888741 +02  +.52368870 +02  +.62757551 +02
190  +.10375728 +02  +.20751457 +02  +.31339652 +02  +.42005790 +02  +.52560079 +02  +.63011000 +02
200  +.10415415 +02  +.20830830 +02  +.31373787 +02  +.42120827 +02  +.52757379 +02  +.63274553 +02
```

TABLE 21

```
             HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 3000 FT.    THICKNESS    400 FT.    N-GRADIENT           50  UNITS/1000 FT.


RANGE                                   4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                 20                 30                 40                 50                 60
        ........           ........           ........           ........           ........           ........
010  +.09997855 +02    +.19992390 +02    +.29982830 +02    +.39969067 +02
020  +.10004898 +02    +.20006023 +02    +.30001773 +02    +.39992405 +02    +.49977577 +02    +.59958135 +02
030  +.10016711 +02    +.20028496 +02    +.30033045 +02    +.40031059 +02    +.50022869 +02    +.60008701 +02
040  +.10031087 +02    +.20059398 +02    +.30076370 +02    +.40084811 +02    +.50085412 +02    +.60078874 +02
050  +.10048710 +02    +.20098051 +02    +.30131034 +02    +.40153119 +02    +.50165304 +02    +.60168511 +02
060  +.10067464 +02    +.20143497 +02    +.30197042 +02    +.40235735 +02    +.50261610 +02    +.60277198 +02
070  +.10087206 +02    +.20194924 +02    +.30272906 +02    +.40331796 +02    +.50374275 +02    +.60403975 +02
080  +.10105381 +02    +.20251070 +02    +.30358006 +02    +.40440014 +02    +.50502038 +02    +.60548734 +02
090  +.10123494 +02    +.20311034 +02    +.30450694 +02    +.40560107 +02    +.50645948 +02    +.60710924 +02
100  +.10140245 +02    +.20370263 +02    +.30549482 +02    +.40690456 +02    +.50802666 +02    +.60890890 +02
110  +.10152290 +02    +.20432202 +02    +.30653850 +02    +.40829667 +02    +.50971666 +02    +.61085221 +02
120  +.10158762 +02    +.20486712 +02    +.30761136 +02    +.40977206 +02    +.51151431 +02    +.61293674 +02
130  +.10182594 +02    +.20538933 +02    +.30868292 +02    +.41130450 +02    +.51341165 +02    +.61514965 +02
140  +.10216153 +02    +.20588082 +02    +.30974337 +02    +.41285801 +02    +.51541741 +02    +.61746420 +02
150  +.10250793 +02    +.20624142 +02    +.31078883 +02    +.41446039 +02    +.51742822 +02    +.61988825 +02
160  +.10286448 +02    +.20651640 +02    +.31168133 +02    +.41601013 +02    +.51953824 +02    +.62242154 +02
170  +.10323028 +02    +.20669733 +02    +.31255667 +02    +.41753839 +02    +.52160150 +02    +.62495364 +02
180  +.10360425 +02    +.20720850 +02    +.31332519 +02    +.41906653 +02    +.52377019 +02    +.62761915 +02
190  +.10398522 +02    +.20797045 +02    +.31384775 +02    +.42031936 +02    +.52572192 +02    +.63017167 +02
200  +.10437197 +02    +.20874394 +02    +.31425949 +02    +.42155527 +02    +.52773540 +02    +.63282613 +02
```

TABLE 22

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 3000 FT. THICKNESS 400 FT. N-GRADIENT 100 UNITS/1000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10	20	30	40	50	60 ....
010	+.09997640 +02	+.19992346 +02	+.29982804 +02	+.39968998 +02		
020	+.10003958 +02	+.20005803 +02	+.30001683 +02	+.39992359 +02	+.49977564 +02	+.59958109 +02
030	+.10013893 +02	+.20027954 +02	+.30032818 +02	+.40030939 +02	+.50022797 +02	+.60008654 +02
040	+.10026419 +02	+.20058348 +02	+.30075930 +02	+.40084578 +02	+.50085269 +02	+.60076781 +02
050	+.10040383 +02	+.20096224 +02	+.30130274 +02	+.40152721 +02	+.50165063 +02	+.60168352 +02
060	+.10053163 +02	+.20140464 +02	+.30195854 +02	+.40235115 +02	+.50261232 +02	+.60276950 +02
070	+.10065310 +02	+.20190116 +02	+.30271101 +02	+.40330875 +02	+.50373716 +02	+.60403607 +02
080	+.10072889 +02	+.20243643 +02	+.30355344 +02	+.40438672 +02	+.50501233 +02	+.60548212 +02
090	+.10080414 +02	+.20300174 +02	+.30446786 +02	+.40558204 +02	+.50644847 +02	+.60710202 +02
100	+.10090408 +02	+.20353134 +02	+.30543727 +02	+.40687780 +02	+.50801157 +02	+.60889930 +02
110	+.10094657 +02	+.20408445 +02	+.30645549 +02	+.40825906 +02	+.50969609 +02	+.61083939 +02
120	+.10092095 +02	+.20450942 +02	+.30749339 +02	+.40971996 +02	+.51148626 +02	+.61291971 +02
130	+.10116772 +02	+.20489890 +02	+.30850936 +02	+.41123276 +02	+.51337356 +02	+.61512712 +02
140	+.10154660 +02	+.20525935 +02	+.30949785 +02	+.41275539 +02	+.51536729 +02	+.61743408 +02
150	+.10193065 +02	+.20551635 +02	+.31045056 +02	+.41432155 +02	+.51735814 +02	+.61984823 +02
160	+.10232019 +02	+.20567783 +02	+.31119238 +02	+.41580846 +02	+.51944463 +02	+.62236963 +02
170	+.10271498 +02	+.20573547 +02	+.31191076 +02	+.41725892 +02	+.52147019 +02	+.62488252 +02
180	+.10311467 +02	+.20622935 +02	+.31252988 +02	+.41869389 +02	+.52359990 +02	+.62752779 +02
190	+.10351862 +02	+.20703724 +02	+.31291984 +02	+.41977764 +02	+.52546930 +02	+.63004268 +02
200	+.10392609 +02	+.20785218 +02	+.31318926 +02	+.42083783 +02	+.52739871 +02	+.63265764 +02

TABLE 23

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 3000 FT.   THICKNESS 400 FT.   N-GRADIENT 200 UNITS/1000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997210 +02	+.19992258 +02	+.29982778 +02	+.39968994 +02		
020	+.10002062 +02	+.20005360 +02	+.30001504 +02	+.39992270 +02	+.49977515 +02	+.59958083 +02
030	+.10009154 +02	+.20026864 +02	+.30032362 +02	+.40030698 +02	+.50022654 +02	+.60008563 +02
040	+.10016685 +02	+.20056228 +02	+.30075045 +02	+.40084108 +02	+.50084984 +02	+.60078594 +02
050	+.10022526 +02	+.20092511 +02	+.30128744 +02	+.40151923 +02	+.50164580 +02	+.60168032 +02
060	+.10020961 +02	+.20134240 +02	+.30193453 +02	+.40233867 +02	+.50260473 +02	+.60276453 +02
070	+.10012898 +02	+.20180127 +02	+.30267435 +02	+.40329020 +02	+.50372593 +02	+.60402870 +02
080	+.09989494 +02	+.20227939 +02	+.30349911 +02	+.40435959 +02	+.50499613 +02	+.60547162 +02
090	+.09965755 +02	+.20276846 +02	+.30438746 +02	+.40554343 +02	+.50642624 +02	+.60708749 +02
100	+.09948888 +02	+.20314786 +02	+.30531752 +02	+.40682320 +02	+.50798102 +02	+.60887997 +02
110	+.09922447 +02	+.20354170 +02	+.30628026 +02	+.40818185 +02	+.50965433 +02	+.61081348 +02
120	+.09885629 +02	+.20362240 +02	+.30724068 +02	+.40961216 +02	+.51142908 +02	+.61288522 +02
130	+.09910894 +02	+.20362715 +02	+.30812585 +02	+.41108308 +02	+.51329545 +02	+.61508136 +02
140	+.09962320 +02	+.20359192 +02	+.30894169 +02	+.41253780 +02	+.51526405 +02	+.61737266 +02
150	+.10012435 +02	+.20344696 +02	+.30965242 +02	+.41402375 +02	+.51721230 +02	+.61976619 +02
160	+.10061612 +02	+.20317090 +02	+.30995843 +02	+.41536230 +02	+.51924797 +02	+.62226277 +02
170	+.10110109 +02	+.20275621 +02	+.31022384 +02	+.41662628 +02	+.52119009 +02	+.62473476 +02
180	+.10158086 +02	+.20316173 +02	+.31036846 +02	+.41782503 +02	+.52323319 +02	+.62733690 +02
190	+.10205654 +02	+.20411309 +02	+.31024717 +02	+.41842039 +02	+.52490531 +02	+.62976865 +02
200	+.10252859 +02	+.20505719 +02	+.30996988 +02	+.41897382 +02	+.52663340 +02	+.63229624 +02

TABLE 24

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 3000 FT.   THICKNESS   800 FT.   N-GRADIENT   50 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10		20		30		40		50		60	
	....		....		....		....		....		....	
010	+.09997463	+02	+.19992308	+02	+.29982767	+02	+.39968787	+02				
020	+.10003180	+02	+.20005620	+02	+.30001609	+02	+.39992321	+02	+.49977539	+02	+.59958073	+02
030	+.10011965	+02	+.20027505	+02	+.30032629	+02	+.40030840	+02	+.50022738	+02	+.60008616	+02
040	+.10022517	+02	+.20057478	+02	+.30075565	+02	+.40084384	+02	+.50085152	+02	+.60078704	+02
050	+.10033372	+02	+.20094707	+02	+.30129645	+02	+.40152392	+02	+.50164863	+02	+.60168220	+02
060	+.10040983	+02	+.20137939	+02	+.30194869	+02	+.40234601	+02	+.50260919	+02	+.60276745	+02
070	+.10046432	+02	+.20186101	+02	+.30269602	+02	+.40330113	+02	+.50373254	+02	+.60403303	+02
080	+.10044496	+02	+.20237412	+02	+.30353132	+02	+.40437560	+02	+.50500567	+02	+.60547780	+02
090	+.10042515	+02	+.20291024	+02	+.30443531	+02	+.40556626	+02	+.50643934	+02	+.60709604	+02
100	+.10046178	+02	+.20338563	+02	+.30538919	+02	+.40685555	+02	+.50799905	+02	+.60889136	+02
110	+.10043055	+02	+.20388137	+02	+.30638587	+02	+.40822776	+02	+.50967902	+02	+.61082876	+02
120	+.10032197	+02	+.20419900	+02	+.30739408	+02	+.40967649	+02	+.51146296	+02	+.61290558	+02
130	+.10057505	+02	+.20446932	+02	+.30836217	+02	+.41117278	+02	+.51334185	+02	+.61510842	+02
140	+.10099314	+02	+.20471176	+02	+.30928840	+02	+.41266923	+02	+.51532553	+02	+.61740905	+02
150	+.10141100	+02	+.20487216	+02	+.31015964	+02	+.41420463	+02	+.51729958	+02	+.61981492	+02
160	+.10182999	+02	+.20492769	+02	+.31076636	+02	+.41563738	+02	+.51936621	+02	+.62232639	+02
170	+.10225075	+02	+.20487041	+02	+.31134415	+02	+.41702054	+02	+.52135976	+02	+.62482312	+02
180	+.10267357	+02	+.20534715	+02	+.31182771	+02	+.41837409	+02	+.52345632	+02	+.62745137	+02
190	+.10309823	+02	+.20619646	+02	+.31209412	+02	+.41930636	+02	+.52525453	+02	+.62993432	+02
200	+.10352429	+02	+.20704858	+02	+.31223081	+02	+.42020917	+02	+.52711122	+02	+.63251575	+02

TABLE 25

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 3000 FT. THICKNESS 800 FT. N-GRADIENT 100 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET					
	10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09996745 +02	+.19992163 +02	+.29982750 +02	+.39968989 +02		
020	+.10000016 +02	+.20004881 +02	+.30001310 +02	+.39992174 +02	+.49977461 +02	+.59958055 +02
030	+.10004051 +02	+.20025687 +02	+.30031870 +02	+.40030439 +02	+.50022500 +02	+.60008466 +02
040	+.10006230 +02	+.20053942 +02	+.30074090 +02	+.40083602 +02	+.50084676 +02	+.60078393 +02
050	+.10003426 +02	+.20088509 +02	+.30127093 +02	+.40151061 +02	+.50164058 +02	+.60167687 +02
060	+.09986809 +02	+.20127540 +02	+.30190863 +02	+.40232520 +02	+.50259653 +02	+.60275916 +02
070	+.09958068 +02	+.20169393 +02	+.30263484 +02	+.40327019 +02	+.50371380 +02	+.60402073 +02
080	+.09903655 +02	+.20211104 +02	+.30344058 +02	+.40433034 +02	+.50497865 +02	+.60546029 +02
090	+.09848700 +02	+.20251896 +02	+.30430093 +02	+.40550181 +02	+.50640226 +02	+.60707181 +02
100	+.09807546 +02	+.20274062 +02	+.30518885 +02	+.40676439 +02	+.50794809 +02	+.60885911 +02
110	+.09753050 +02	+.20296741 +02	+.30609242 +02	+.40809876 +02	+.50960932 +02	+.61078553 +02
120	+.09684721 +02	+.20270109 +02	+.30697028 +02	+.40949624 +02	+.51135747 +02	+.61284802 +02
130	+.09710937 +02	+.20231887 +02	+.30771770 +02	+.41092230 +02	+.51321135 +02	+.61503204 +02
140	+.09775376 +02	+.20189121 +02	+.30835221 +02	+.41230465 +02	+.51515296 +02	+.61730650 +02
150	+.09836759 +02	+.20137716 +02	+.30881384 +02	+.41370516 +02	+.51705560 +02	+.61967787 +02
160	+.09895793 +02	+.20069780 +02	+.30868094 +02	+.41488751 +02	+.51903695 +02	+.62214778 +02
170	+.09953000 +02	+.19984657 +02	+.30848975 +02	+.41595547 +02	+.52089018 +02	+.62457596 +02
180	+.10008721 +02	+.20017443 +02	+.30817076 +02	+.41690947 +02	+.52284114 +02	+.62713189 +02
190	+.10063215 +02	+.20126430 +02	+.30757775 +02	+.41701256 +02	+.52430600 +02	+.62947506 +02
200	+.10116655 +02	+.20233311 +02	+.30679474 +02	+.41705483 +02	+.52582253 +02	+.63190958 +02

TABLE 26

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 3000 FT.    THICKNESS    800 FT.    N-GRADIENT          .200  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES       10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010  +.09995303 +02    +.19991869 +02    +.29982664 +02    +.39968976 +02
020  +.09992567 +02    +.20003398 +02    +.30000711 +02    +.39991876 +02    +.49977296 +02    +.59957967 +02
030  +.09987494 +02    +.20022010 +02    +.30030342 +02    +.40029634 +02    +.50022023 +02    +.60008163 +02
040  +.09970632 +02    +.20046727 +02    +.30071112 +02    +.40082030 +02    +.50083722 +02    +.60077769 +02
050  +.09933518 +02    +.20075698 +02    +.30121914 +02    +.40148378 +02    +.50162440 +02    +.60166619 +02
060  +.09841272 +02    +.20105616 +02    +.30182679 +02    +.40228310 +02    +.50257102 +02    +.60274250 +02
070  +.08571428 +01    +.17142856 +01    +.25714284 +01    +.40320731 +02    +.50367594 +02    +.60399596 +02
080  +.07499999 +01    +.14999999 +01    +.22499999 +01    +.29999998 +01    +.50492382 +02    +.60542495 +02
090  +.06666666 +01    +.13333332 +01    +.19999999 +01    +.26666665 +01    +.50632673 +02    +.60702274 +02
100  +.05999999 +01    +.11999999 +01    +.17999999 +01    +.23999999 +01    +.50784373 +02    +.60879359 +02
110  +.05454545 +01    +.10909090 +01    +.16363635 +01    +.21818181 +01    +.27272726 +01    +.61069735 +02
120  +.49999998 -00    +.09999999 +01    +.14999999 +01    +.19999999 +01    +.24999999 +01    +.29999998 +01
130  +.46153844 -00    +.09230768 +01    +.13846153 +01    +.18461537 +01    +.23076922 +01    +.27692306 +01
140  +.42857141 -00    +.08571428 +01    +.12857142 +01    +.17142856 +01    +.21428570 +01    +.25714284 +01
150  +.39999998 -00    +.07999999 +01    +.11999999 +01    +.15999999 +01    +.19999999 +01    +.23999999 +01
160  +.37499998 -00    +.07499999 +01    +.11249999 +01    +.14999999 +01    +.18749999 +01    +.22499999 +01
170  +.35294116 -00    +.07058823 +01    +.10588234 +01    +.14117646 +01    +.17647058 +01    +.21176469 +01
180  +.33333332 -00    +.06666666 +01    +.09999999 +01    +.13333332 +01    +.16666666 +01    +.19999999 +01
190  +.31578946 -00    +.06315789 +01    +.09473683 +01    +.12631578 +01    +.15789473 +01    +.18947367 +01
200  +.10725662 +01    +.21451324 +01    +.32387606 +02    +.42183475 +02    +.52227408 +02    +.63049338 +02
TRAPPING OCCURS FOR ALL ANGLES LESS THAN    1.5 DEGREES
```

TABLE 27

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 4000 FT.    THICKNESS    200 FT.    N-GRADIENT         .     50  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES        10                  20                  30                  40                  50                  60
           ........            ........            ........            ........            ........            ........
010   +.09997967  +02    +.19992412  +02    +.29982825  +02    +.39969054  +02
020   +.10005390  +02    +.20006138  +02    +.30001820  +02    +.39992427  +02    +.49977596  +02    +.59956131  +02
030   +.10017429  +02    +.20028780  +02    +.30033163  +02    +.40031122  +02    +.50022906  +02    +.60008722  +02
040   +.10033556  +02    +.20059947  +02    +.30076600  +02    +.40084934  +02    +.50085486  +02    +.60078923  +02
050   +.10053143  +02    +.20099009  +02    +.30131431  +02    +.40153326  +02    +.50165429  +02    +.60168594  +02
060   +.10075116  +02    +.20145094  +02    +.30197664  +02    +.40236059  +02    +.50261807  +02    +.60277328  +02
070   +.10098910  +02    +.20197465  +02    +.30273853  +02    +.40332277  +02    +.50374567  +02    +.60404166  +02
080   +.10122677  +02    +.20255012  +02    +.30359404  +02    +.40440716  +02    +.50502458  +02    +.60549007  +02
090   +.10146368  +02    +.20316817  +02    +.30452754  +02    +.40561104  +02    +.50646524  +02    +.60711301  +02
100   +.10166504  +02    +.20379419  +02    +.30552524  +02    +.40691863  +02    +.50803456  +02    +.60891391  +02
110   +.10182617  +02    +.20444925  +02    +.30658254  +02    +.40831648  +02    +.50972744  +02    +.61085893  +02
120   +.10193488  +02    +.20505786  +02    +.30767414  +02    +.40979956  +02    +.51152904  +02    +.61294567  +02
130   +.10216857  +02    +.20565014  +02    +.30877560  +02    +.41134246  +02    +.51343170  +02    +.61516147  +02
140   +.10248136  +02    +.20621054  +02    +.30987474  +02    +.41291252  +02    +.51544383  +02    +.61748003  +02
150   +.10280811  +02    +.20662314  +02    +.31096971  +02    +.41453430  +02    +.51746527  +02    +.61990931  +02
160   +.10314755  +02    +.20695526  +02    +.31194182  +02    +.41611780  +02    +.51958785  +02    +.62244890  +02
170   +.10349820  +02    +.20719819  +02    +.31289999  +02    +.41768796  +02    +.52167134  +02    +.62499122  +02
180   +.10385881  +02    +.20771763  +02    +.31374643  +02    +.41926590  +02    +.52386090  +02    +.62766751  +02
190   +.10422778  +02    +.20845557  +02    +.31433556  +02    +.42060802  +02    +.52585690  +02    +.63024019  +02
200   +.10460375  +02    +.20920750  +02    +.31481893  +02    +.42193670  +02    +.52791559  +02    +.63291582  +02
```

TABLE 28

```
              HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 4000 FT.    THICKNESS    200 FT.    N-GRADIENT          100 'UNITS/1000 FT.

RANGE                                 4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010   +.09997896 +02      +.19992398 +02      +.29982820 -02      +.39969000 +02
020   +.10005083 +02      +.20006065 +02      +.30001790 -02      +.39992412 +02      +.49977593 +02      +.59958125 +02
030   +.10016695 +02      +.20028601 +02      +.30033088 +02      +.40031082 +02      +.50022882 +02      +.60008708 +02
040   +.10032142 +02      +.20059605 +02      +.30076455 +02      +.40084856 +02      +.50085439 +02      +.60078892 +02
050   +.10050763 +02      +.20098423 +02      +.30131182 +02      +.40153195 +02      +.50165350 +02      +.60168541 +02
060   +.10071375 +02      +.20144141 +02      +.30197278 +02      +.40235855 +02      +.50261683 +02      +.60277246 +02
070   +.10093668 +02      +.20195997 +02      +.30273272 +02      +.40331976 +02      +.50374383 +02      +.60404045 +02
080   +.10115650 +02      +.20252825 +02      +.30358559 +02      +.40440281 +02      +.50502194 +02      +.60548835 +02
090   +.10137556 +02      +.20313723 +02      +.30451534 +02      +.40560492 +02      +.50646165 +02      +.60711064 +02
100   +.10156900 +02      +.20374887 +02      +.30550772 +02      +.40691011 +02      +.50802967 +02      +.60891077 +02
110   +.10172039 +02      +.20438882 +02      +.30655801 +02      +.40830468 +02      +.50972083 +02      +.61085475 +02
120   +.10181775 +02      +.20497635 +02      +.30764033 +02      +.40978350 +02      +.51152011 +02      +.61294015 +02
130   +.10205409 +02      +.20554572 +02      +.30872854 +02      +.41132075 +02      +.51341972 +02      +.61515423 +02
140   +.10237450 +02      +.20608416 +02      +.30981123 +02      +.41288246 +02      +.51542823 +02      +.61747043 +02
150   +.10270781 +02      +.20648393 +02      +.31088714 +02      +.41449461 +02      +.51744394 +02      +.61989671 +02
160   +.10305297 +02      +.20680172 +02      +.31183312 +02      +.41606326 +02      +.51955991 +02      +.62243272 +02
170   +.10340866 +02      +.20702888 +02      +.31276400 +02      +.41761554 +02      +.52163335 +02      +.62496950 +02
180   +.10377377 +02      +.20754754 +02      +.31358649 +02      +.41917357 +02      +.52381260 +02      +.62763995 +02
190   +.10414675 +02      +.20829350 +02      +.31415896 +02      +.42048629 +02      +.52578970 +02      +.63020257 +02
200   +.10452632 +02      +.20905264 +02      +.31462421 +02      +.42178432 +02      +.52782905 +02      +.63286766 +02
```

TABLE II

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 4000 FT.    THICKNESS    200 FT.    N-GRADIENT          . 200  UNITS/1000 FT.

RANGE                                 4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES       10                  20                  30                  40                  50                  60
        ........            ........            ........            ........            ........            ........
010  +.09997753 +02     +.19992369 +02     +.29982811 +02     +.39968999 +02
020  +.10004468 +02     +.20005919 +02     +.30001730 +02     +.39992383 +02     +.49977577 +02     +.59950117 +02
030  +.10015212 +02     +.20028243 +02     +.30032937 +02     +.40031002 +02     +.50022835 +02     +.60008678 +02
040  +.10029259 +02     +.20058918 +02     +.30076164 +02     +.40084701 +02     +.50085344 +02     +.60078830 +02
050  +.10045853 +02     +.20097242 +02     +.30130682 +02     +.40152932 +02     +.50165190 +02     +.60168435 +02
060  +.10063531 +02     +.20142213 +02     +.30196501 +02     +.40235446 +02     +.50261432 +02     +.60277081 +02
070  +.10082504 +02     +.20193007 +02     +.30272102 +02     +.40331372 +02     +.50374014 +02     +.60403802 +02
080  +.10100415 +02     +.20248341 +02     +.30356852 +02     +.40439405 +02     +.50501665 +02     +.60548490 +02
090  +.10118256 +02     +.20307337 +02     +.30449062 +02     +.40559259 +02     +.50645443 +02     +.60710589 +02
100  +.10135672 +02     +.20365406 +02     +.30547203 +02     +.40689291 +02     +.50801983 +02     +.60890447 +02
110  +.10148467 +02     +.20426141 +02     +.30650774 +02     +.40828079 +02     +.50970750 +02     +.61084636 +02
120  +.10155491 +02     +.20480128 +02     +.30757065 +02     +.40975085 +02     +.51150208 +02     +.61292906 +02
130  +.10179671 +02     +.20531867 +02     +.30863055 +02     +.41127648 +02     +.51339547 +02     +.61513963 +02
140  +.10213422 +02     +.20580709 +02     +.30967775 +02     +.41282078 +02     +.51539661 +02     +.61745107 +02
150  +.10248230 +02     +.20617602 +02     +.31071187 +02     +.41441277 +02     +.51740048 +02     +.61987122 +02
160  +.10284031 +02     +.20645950 +02     +.31159864 +02     +.41594962 +02     +.51950278 +02     +.62239992 +02
170  +.10320741 +02     +.20664913 +02     +.31246770 +02     +.41746340 +02     +.52155520 +02     +.62492527 +02
180  +.10358251 +02     +.20716502 +02     +.31323524 +02     +.41897805 +02     +.52371284 +02     +.62758371 +02
190  +.10396451 +02     +.20792902 +02     +.31376775 +02     +.42022417 +02     +.52564923 +02     +.63012528 +02
200  +.10435217 +02     +.20870435 +02     +.31418972 +02     +.42145283 +02     +.52764696 +02     +.63276833 +02
```

TABLE 30

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 4000 FT.   THICKNESS   400 FT.   N-GRADIENT   '50 UNITS/1000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10	20	30	40	50	60
010	+.09997854 +02	+.19992388 +02	+.29982828 +02	+.39968894 +02		
020	+.10004903 +02	+.20006022 +02	+.30001772 +02	+.39992400 +02	+.49977588 +02	+.59958123 +02
030	+.10016263 +02	+.20028496 +02	+.30033044 +02	+.40031058 +02	+.50022868 +02	+.60006598 +02
040	+.10031306 +02	+.20059404 +02	+.30076370 +02	+.40084811 +02	+.50085411 +02	+.60078173 +02
050	+.10049348 +02	+.20098078 +02	+.30131054 +02	+.40153116 +02	+.50165203 +02	+.60168510 +02
060	+.10069135 +02	+.20143590 +02	+.30197051 +02	+.40235725 +02	+.50261609 +02	+.60277197 +02
070	+.10090509 +02	+.20195129 +02	+.30272930 +02	+.40331799 +02	+.50374175 +02	+.60403974 +02
080	+.10111385 +02	+.20251528 +02	+.30356061 +02	+.40440025 +02	+.50502089 +02	+.60540734 +02
090	+.10132186 +02	+.20311883 +02	+.30450815 +02	+.40560132 +02	+.50645954 +02	+.60710925 +02
100	+.10151027 +02	+.20372177 +02	+.30549736 +02	+.40692509 +02	+.50802610 +02	+.60890093 +02
110	+.10165550 +02	+.20435255 +02	+.30654247 +02	+.40829772 +02	+.50971694 +02	+.61085209 +02
120	+.10174572 +02	+.20492707 +02	+.30762024 +02	+.40977401 +02	+.51151405 +02	+.61293621 +02
130	+.10198363 +02	+.20548227 +02	+.30870045 +02	+.41130781 +02	+.51341206 +02	+.61514227 +02
140	+.10230873 +02	+.20600712 +02	+.30977316 +02	+.41286464 +02	+.51541903 +02	+.61746479 +02
150	+.10264602 +02	+.20639678 +02	+.31083746 +02	+.41447102 +02	+.51743113 +02	+.61988729 +02
160	+.10299476 +02	+.20670752 +02	+.31176728 +02	+.41603070 +02	+.51954387 +02	+.62242018 +02
170	+.10335357 +02	+.20692479 +02	+.31268120 +02	+.41757215 +02	+.52161090 +02	+.62495666 +02
180	+.10372142 +02	+.20744284 +02	+.31348802 +02	+.41911807 +02	+.52378397 +02	+.62762105 +02
190	+.10409687 +02	+.20819374 +02	+.31405097 +02	+.42041261 +02	+.52574952 +02	+.63018074 +02
200	+.10447865 +02	+.20895731 +02	+.31450471 +02	+.42169172 +02	+.52777716 +02	+.63283103 +02

TABLE 31

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 4000 FT.   THICKNESS   400 FT.   N-GRADIENT   . 100 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10		20		30		40		50		60	
	....		....		....		....		....		....	
010	+.09997640	+02	+.19992345	+02	+.29982804	+02	+.39968997	+02				
020	+.10003980	+02	+.20005802	+02	+.30001683	+02	+.39992359	+02	+.49977564	+02	+.59958109	+02
030	+.10014035	+02	+.20027960	+02	+.30032818	+02	+.40030939	+02	+.50022797	+02	+.60008654	+02
040	+.10026972	+02	+.20058373	+02	+.30075933	+02	+.40084578	+02	+.50085269	+02	+.60078780	+02
050	+.10041960	+02	+.20096304	+02	+.30130286	+02	+.40152723	+02	+.50165063	+02	+.60168351	+02
060	+.10057314	+02	+.20140683	+02	+.30195885	+02	+.40235121	+02	+.50261233	+02	+.60276950	+02
070	+.10073659	+02	+.20190636	+02	+.30271174	+02	+.40330892	+02	+.50373722	+02	+.60403609	+02
080	+.10088353	+02	+.20244784	+02	+.30355497	+02	+.40438710	+02	+.50501246	+02	+.60548216	+02
090	+.10102983	+02	+.20302272	+02	+.30447102	+02	+.40558281	+02	+.50644871	+02	+.60710211	+02
100	+.10118885	+02	+.20357888	+02	+.30544372	+02	+.40687926	+02	+.50801202	+02	+.60889947	+02
110	+.10129836	+02	+.20416040	+02	+.30646788	+02	+.40826184	+02	+.50969692	+02	+.61083970	+02
120	+.10134726	+02	+.20466259	+02	+.30751538	+02	+.40972495	+02	+.51148777	+02	+.61292026	+02
130	+.10159353	+02	+.20513889	+02	+.30855284	+02	+.41124136	+02	+.51337623	+02	+.61512806	+02
140	+.10194439	+02	+.20558786	+02	+.30957193	+02	+.41277186	+02	+.51537152	+02	+.61743571	+02
150	+.10230412	+02	+.20593248	+02	+.31057294	+02	+.41434785	+02	+.51736600	+02	+.61985099	+02
160	+.10267227	+02	+.20618895	+02	+.31141294	+02	+.41585949	+02	+.51945746	+02	+.62237391	+02
170	+.10304838	+02	+.20634902	+02	+.31223309	+02	+.41734281	+02	+.52149322	+02	+.62489018	+02
180	+.10343137	+02	+.20686274	+02	+.31295732	+02	+.41882307	+02	+.52363371	+02	+.62753910	+02
190	+.10382049	+02	+.20764099	+02	+.31345829	+02	+.42001652	+02	+.52553785	+02	+.63006398	+02
200	+.10421455	+02	+.20842910	+02	+.31384617	+02	+.42119033	+02	+.52750258	+02	+.63268955	+02

TABLE 32

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 4000 FT. THICKNESS 400 FT. N-GRADIENT . 200 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10	20	30	40	50	60 ....
010	+.09997212 +02	+.19992258 +02	+.29982778 +02	+.39968994 +02		
020	+.10002115 +02	+.20005361 +02	+.30001504 +02	+.39992270 +02	+.49977514 +02	+.59958083 +02
030	+.10009484 +02	+.20026880 +02	+.30032364 +02	+.40030699 +02	+.50022654 +02	+.60008563 +02
040	+.10017953 +02	+.20056292 +02	+.30075055 +02	+.40084111 +02	+.50084984 +02	+.60078594 +02
050	+.10026208 +02	+.20092700 +02	+.30128776 +02	+.40151930 +02	+.50164582 +02	+.60168033 +02
060	+.10031144 +02	+.20134745 +02	+.30193530 +02	+.40233887 +02	+.50260479 +02	+.60276455 +02
070	+.10034906 +02	+.20181318 +02	+.30267609 +02	+.40329065 +02	+.50372609 +02	+.60402876 +02
080	+.10032977 +02	+.20230581 +02	+.30350266 +02	+.40436053 +02	+.50499646 +02	+.60547176 +02
090	+.10031029 +02	+.20281749 +02	+.30439469 +02	+.40554524 +02	+.50642685 +02	+.60708775 +02
100	+.10037544 +02	+.20326400 +02	+.30533233 +02	+.40682661 +02	+.50798213 +02	+.60888041 +02
110	+.10037369 +02	+.20372977 +02	+.30630892 +02	+.40818825 +02	+.50965631 +02	+.61081426 +02
120	+.10029584 +02	+.20404118 +02	+.30729201 +02	+.40962362 +02	+.51143259 +02	+.61288654 +02
130	+.10055885 +02	+.20430724 +02	+.30823089 +02	+.41110279 +02	+.51330160 +02	+.61508358 +02
140	+.10097801 +02	+.20455160 +02	+.30912417 +02	+.41257602 +02	+.51527374 +02	+.61737646 +02
150	+.10139679 +02	+.20475003 +02	+.30996947 +02	+.41408517 +02	+.51723034 +02	+.61977257 +02
160	+.10181658 +02	+.20484523 +02	+.31057074 +02	+.41548571 +02	+.51927756 +02	+.62227257 +02
170	+.10223806 +02	+.20482945 +02	+.31114200 +02	+.41683287 +02	+.52124375 +02	+.62475234 +02
180	+.10266151 +02	+.20532303 +02	+.31163642 +02	+.41815432 +02	+.52331243 +02	+.62736283 +02
190	+.10308673 +02	+.20617347 +02	+.31194933 +02	+.41907968 +02	+.52507242 +02	+.62981815 +02
200	+.10351330 +02	+.20702660 +02	+.31213449 +02	+.41997455 +02	+.52688986 +02	+.63237076 +02

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HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 4000 FT. THICKNESS 800 FT. N-GRADIENT 50 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET 10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997460 +02	+.19992308 +02	+.29982803 +02	+.39968978 +02		
020	+.10003197 +02	+.20005617 +02	+.30001607 +02	+.39992321 +02	+.49977547 +02	+.59958109 +02
030	+.10012141 +02	+.20027505 +02	+.30032626 +02	+.40030837 +02	+.50022737 +02	+.60008615 +02
040	+.10023268 +02	+.20057500 +02	+.30075563 +02	+.40084381 +02	+.50085149 +02	+.60078702 +02
050	+.10035606 +02	+.20094799 +02	+.30129652 +02	+.40152389 +02	+.50164860 +02	+.60168217 +02
060	+.10047054 +02	+.20138218 +02	+.30194898 +02	+.40234602 +02	+.50260916 +02	+.60276742 +02
070	+.10058907 +02	+.20186800 +02	+.30269683 +02	+.40330125 +02	+.50373253 +02	+.60403300 +02
080	+.10067994 +02	+.20239003 +02	+.30353319 +02	+.40437596 +02	+.50500573 +02	+.60547778 +02
090	+.10077029 +02	+.20294003 +02	+.30443940 +02	+.40556710 +02	+.50643953 +02	+.60709607 +02
100	+.10090183 +02	+.20345499 +02	+.30539791 +02	+.40685732 +02	+.50799950 +02	+.60889147 +02
110	+.10097811 +02	+.20399308 +02	+.30640311 +02	+.40823130 +02	+.50967995 +02	+.61082902 +02
120	+.10098866 +02	+.20442996 +02	+.30742522 +02	+.40968312 +02	+.51146477 +02	+.61290614 +02
130	+.10124218 +02	+.20483480 +02	+.30842517 +02	+.41118448 +02	+.51334524 +02	+.61510947 +02
140	+.10161613 +02	+.20521506 +02	+.30939701 +02	+.41269228 +02	+.51533105 +02	+.61741102 +02
150	+.10199594 +02	+.20551589 +02	+.31034172 +02	+.41424191 +02	+.51731022 +02	+.61981842 +02
160	+.10238176 +02	+.20572381 +02	+.31110044 +02	+.41571138 +02	+.51938393 +02	+.62233194 +02
170	+.10277330 +02	+.20583066 +02	+.31183567 +02	+.41714351 +02	+.52139224 +02	+.62483344 +02
180	+.10317007 +02	+.20634015 +02	+.31248408 +02	+.41856553 +02	+.52350445 +02	+.62746681 +02
190	+.10357142 +02	+.20714284 +02	+.31292839 +02	+.41966758 +02	+.52535439 +02	+.62996421 +02
200	+.10397654 +02	+.20795309 +02	+.31325505 +02	+.42074617 +02	+.52726371 +02	+.63256098 +02

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HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 4000 FT.    THICKNESS    800 FT.    N-GRADIENT         . 100  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                20                30                40                50                60
         ........          ........          ........          ........          ........          ........
010  +.09996745 +02  +.19992162 +02  +.29982750 +02  +.39968989 +02
020  +.10000087 +02  +.20004881 +02  +.30001309 +02  +.39992173 +02  +.49977461 +02  +.59958055 +02
030  +.10004539 +02  +.20025705 +02  +.30031870 +02  +.40030437 +02  +.50022499 +02  +.60008464 +02
040  +.10008176 +02  +.20054027 +02  +.30074099 +02  +.40083602 +02  +.50084675 +02  +.60078391 +02
050  +.10009188 +02  +.20088781 +02  +.30127133 +02  +.40151068 +02  +.50164058 +02  +.60167686 +02
060  +.10003039 +02  +.20128296 +02  +.30190968 +02  +.40232543 +02  +.50259658 +02  +.60275916 +02
070  +.09993578 +02  +.20171214 +02  +.30263732 +02  +.40327076 +02  +.50371397 +02  +.60402078 +02
080  +.09974434 +02  +.20215208 +02  +.30344582 +02  +.40433162 +02  +.50497906 +02  +.60546043 +02
090  +.09955337 +02  +.20259578 +02  +.30431182 +02  +.40550439 +02  +.50640306 +02  +.60707213 +02
100  +.09952563 +02  +.20292548 +02  +.30521153 +02  +.40676938 +02  +.50794962 +02  +.60885967 +02
110  +.09941285 +02  +.20326798 +02  +.30613688 +02  +.40810832 +02  +.50961214 +02  +.61078658 +02
120  +.09920763 +02  +.20338093 +02  +.30705060 +02  +.40951366 +02  +.51137262 +02  +.61284987 +02
130  +.09948871 +02  +.20342860 +02  +.30788421 +02  +.41095257 +02  +.51322055 +02  +.61503522 +02
140  +.09997805 +02  +.20346086 +02  +.30864342 +02  +.41236411 +02  +.51516760 +02  +.61731207 +02
150  +.10045769 +02  +.20351301 +02  +.30932444 +02  +.41380132 +02  +.51708323 +02  +.61968738 +02
160  +.10093073 +02  +.20344646 +02  +.30967757 +02  +.41508329 +02  +.51908268 +02  +.62216255 +02
170  +.10139905 +02  +.20325393 +02  +.30998972 +02  +.41628525 +02  +.52097398 +02  +.62460283 +02
180  +.10186419 +02  +.20372838 +02  +.31024725 +02  +.41743873 +02  +.52296541 +02  +.62717177 +02
190  +.10232665 +02  +.20465331 +02  +.31037124 +02  +.41808489 +02  +.52457178 +02  +.62955219 +02
200  +.10278677 +02  +.20557354 +02  +.31035254 +02  +.41868930 +02  +.52623219 +02  +.63202626 +02
```

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HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 4000 FT.    THICKNESS    800 FT.    N-GRADIENT            200  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                    20                    30                    40                    50                    60
        ........              ........              ........              ........              ........              ........
010  +.09995309 +02   +.19991869 +02   +.29982664 +02   +.39968976 +02
020  +.09993750 +02   +.20003404 +02   +.30000711 +02   +.39991875 +02   +.49977296 +02   +.59957967 +02
030  +.09988654 +02   +.20022065 +02   +.30030349 +02   +.40029635 +02   +.50022022 +02   +.60008162 +02
040  +.09975346 +02   +.20046943 +02   +.30071146 +02   +.40082037 +02   +.50083724 +02   +.60077769 +02
050  +.09948379 +02   +.20076353 +02   +.30122023 +02   +.40148404 +02   +.50162447 +02   +.60166621 +02
060  +.09890777 +02   +.20107413 +02   +.30182943 +02   +.40228378 +02   +.50257125 +02   +.60274258 +02
070  +.09801175 +02   +.20137564 +02   +.30251468 +02   +.40320881 +02   +.50367647 +02   +.60399617 +02
080  +.09999975 +01   +.19999949 +01   +.29999924 +01   +.39999899 +01   +.50492496 +02   +.60542540 +02
090  +.08888866 +01   +.17777733 +01   +.26666599 +01   +.35555466 +01   +.50632880 +02   +.60702362 +02
100  +.07999980 +01   +.15999960 +01   +.23999940 +01   +.31999920 +01   +.50784752 +02   +.60879510 +02
110  +.07272709 +01   +.14545418 +01   +.21818127 +01   +.29090836 +01   +.36363545 +01   +.61070000 +02
120  +.06666650 +01   +.13333299 +01   +.19999949 +01   +.26666599 +01   +.33333249 +01   +.39999899 +01
130  +.06153830 +01   +.12307661 +01   +.18461492 +01   +.24615323 +01   +.30769153 +01   +.36922934 +01
140  +.05714271 +01   +.11428542 +01   +.17142814 +01   +.22857085 +01   +.28571357 +01   +.34285628 +01
150  +.05333320 +01   +.10666640 +01   +.15999960 +01   +.21333280 +01   +.26666600 +01   +.31999920 +01
160  +.49999875 -00   +.09999975 +01   +.14999962 +01   +.19999950 +01   +.24999937 +01   +.29999924 +01
170  +.47058705 -00   +.09411741 +01   +.14117611 +01   +.18823482 +01   +.23529352 +01   +.28235223 +01
180  +.44444333 -00   +.08888866 +01   +.13333299 +01   +.17777733 +01   +.22222166 +01   +.26666599 +01
190  +.42105157 -00   +.08421031 +01   +.12631547 +01   +.16842063 +01   +.21052578 +01   +.25263094 +01
200  +.14300847 +01   +.28601695 +01   +.11520250 +02   +.41129382 +02   +.52354917 +02   +.63079457 +02

TRAPPING OCCURS FOR ALL ANGLES LESS THAN     .5 DEGREES
```

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HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 5000 FT.    THICKNESS    200 FT.    N-GRADIENT        .    50  UNITS/1000 FT.

RANGE                                 4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
        ........            ........            ........            ........            ........            ........
010  +.09997967 +02     +.19992413 +02     +.29982845 +02     +.39968975 +02
020  +.10005391 +02     +.20006138 +02     +.30001819 +02     +.39992427 +02     +.49977606 +02     +.59958151 +02
030  +.10017446 +02     +.20028780 +02     +.30033163 +02     +.40031121 +02     +.50022906 +02     +.60008723 +02
040  +.10033621 +02     +.20059949 +02     +.30076600 +02     +.40084934 +02     +.50085486 +02     +.60078922 +02
050  +.10053318 +02     +.20099018 +02     +.30131432 +02     +.40153326 +02     +.50165429 +02     +.60168594 +02
060  +.10075520 +02     +.20145120 +02     +.30197667 +02     +.40236059 +02     +.50261807 +02     +.60277327 +02
070  +.10099622 +02     +.20197527 +02     +.30273861 +02     +.40332278 +02     +.50374567 +02     +.60404166 +02
080  +.10123836 +02     +.20255142 +02     +.30359422 +02     +.40440720 +02     +.50502459 +02     +.60549007 +02
090  +.10147966 +02     +.20317049 +02     +.30452791 +02     -.40561112 +02     +.50646526 +02     +.60711301 +02
100  +.10168357 +02     +.20379888 +02     +.30552601 +02     +.40691879 +02     +.50803461 +02     +.60891392 +02
110  +.10184766 +02     +.20445646 +02     +.30658396 +02     +.40831681 +02     +.50972754 +02     +.61085895 +02
120  +.10195972 +02     +.20507004 +02     +.30767658 +02     +.40980016 +02     +.51152921 +02     +.61294573 +02
130  +.10219312 +02     +.20566784 +02     +.30878002 +02     +.41134348 +02     +.51343202 +02     +.61516157 +02
140  +.10250427 +02     +.20623360 +02     +.30988188 +02     +.41291438 +02     +.51544433 +02     +.61748021 +02
150  +.10282961 +02     +.20665008 +02     +.31098049 +02     +.41453721 +02     +.51746620 +02     +.61990964 +02
160  +.10316782 +02     +.20698646 +02     +.31195884 +02     +.41612298 +02     +.51958934 +02     +.62244941 +02
170  +.10351740 +02     +.20723402 +02     +.31292349 +02     +.41769606 +02     +.52167392 +02     +.62499213 +02
180  +.10387705 +02     +.20775410 +02     +.31377594 +02     +.41927759 +02     +.52386461 +02     +.62766885 +02
190  +.10424516 +02     +.20849032 +02     +.31437004 +02     +.42062669 +02     +.52586371 +02     +.63024259 +02
200  +.10462035 +02     +.20924070 +02     +.31485873 +02     +.42196262 +02     +.52792554 +02     +.63291936 +02
```

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```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 5000 FT.    THICKNESS    200 FT.    N-GRADIENT           100  UNITS/1000 FT.


RANGE                                   4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010  +.09997896 +02   +.19992398 +02   +.29982820 +02   +.39969000 +02
020  +.10005090 +02   +.20006066 +02   +.30001790 +02   +.39992412 +02   +.49977593 +02   +.59958125 +02
030  +.10016740 +02   +.20028603 +02   +.30033088 +02   +.40031082 +02   +.50022882 +02   +.60008708 +02
040  +.10032303 +02   +.20059614 +02   +.30076456 +02   +.40084856 +02   +.50085439 +02   +.60078891 +02
050  +.10051184 +02   +.20098449 +02   +.30131186 +02   +.40153196 +02   +.50165350 +02   +.60168541 +02
060  +.10072342 +02   +.20144209 +02   +.30197288 +02   +.40235857 +02   +.50261683 +02   +.60277246 +02
070  +.10095371 +02   +.20196150 +02   +.30273296 +02   +.40331981 +02   +.50374385 +02   +.60404046 +02
080  +.10118426 +02   +.20253141 +02   +.30358607 +02   +.40440293 +02   +.50502198 +02   +.60548836 +02
090  +.10141391 +02   +.20314282 +02   +.30451631 +02   +.40560516 +02   +.50646173 +02   +.60711067 +02
100  +.10161357 +02   +.20376009 +02   +.30550962 +02   +.40691057 +02   +.50802982 +02   +.60891083 +02
110  +.10177221 +02   +.20440602 +02   +.30656147 +02   +.40830553 +02   +.50972110 +02   +.61085485 +02
120  +.10187776 +02   +.20500552 +02   +.30764623 +02   +.40978499 +02   +.51152059 +02   +.61294033 +02
130  +.10211341 +02   +.20558813 +02   +.30873914 +02   +.41132326 +02   +.51342055 +02   +.61515453 +02
140  +.10242986 +02   +.20613951 +02   +.30982828 +02   +.41288700 +02   +.51542952 +02   +.61747095 +02
150  +.10275978 +02   +.20654876 +02   +.31091290 +02   +.41450164 +02   +.51744625 +02   +.61989757 +02
160  +.10310198 +02   +.20687695 +02   +.31187390 +02   +.41607566 +02   +.51956356 +02   +.62243403 +02
170  +.10345505 +02   +.20711540 +02   +.31282036 +02   +.41763489 +02   +.52163959 +02   +.62497176 +02
180  +.10381783 +02   +.20763567 +02   +.31365736 +02   +.41920149 +02   +.52382155 +02   +.62764324 +02
190  +.10418874 +02   +.20837748 +02   +.31424194 +02   +.42053101 +02   +.52580599 +02   +.63020840 +02
200  +.10456644 +02   +.20913288 +02   +.31472022 +02   +.42184647 +02   +.52785281 +02   +.63287619 +02
```

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HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

TRAPPING LAYER TOP 5000 FT. THICKNESS 200 FT. N-GRADIENT 200 UNITS/1000 FT.

RANGE IN MILES	4/3-EARTH HEIGHT IN KILOFEET					
	10	20	30	40	50	60
	....	....	....	....	....	....
010	+.09997754 +02	+.19992368 +02	+.29982811 +02	+.39968999 +02		
020	+.10004485 +02	+.20005920 +02	+.30001720 +02	+.39992382 +02	+.49977577 +02	+.59958117 +02
030	+.10015313 +02	+.20028249 +02	+.30032938 +02	+.40031002 +02	+.50022834 +02	+.60008678 +02
040	+.10029618 +02	+.20058939 +02	+.30076167 +02	+.40084702 +02	+.50085344 +02	+.60078830 +02
050	+.10046724 +02	+.20097301 +02	+.30130602 +02	+.40152934 +02	+.50165191 +02	+.60168436 +02
060	+.10065714 +02	+.20142366 +02	+.30196527 +02	+.40235453 +02	+.50261434 +02	+.60277082 +02
070	+.10086402 +02	+.20193349 +02	+.30272157 +02	+.40331356 +02	+.50374019 +02	+.60403804 +02
080	+.10106868 +02	+.20249046 +02	+.30356962 +02	+.40439435 +02	+.50501676 +02	+.60548494 +02
090	+.10127233 +02	+.20308584 +02	+.30449279 +02	+.40559316 +02	+.50645463 +02	+.60710597 +02
100	+.10146207 +02	+.20367936 +02	+.30547626 +02	+.40689396 +02	+.50802019 +02	+.60890462 +02
110	+.10160801 +02	+.20430036 +02	+.30651545 +02	+.40828272 +02	+.50970813 +02	+.61084661 +02
120	+.10169856 +02	+.20486859 +02	+.30758380 +02	+.40975420 +02	+.51150317 +02	+.61292949 +02
130	+.10193891 +02	+.20541747 +02	+.30865427 +02	+.41128206 +02	+.51339734 +02	+.61514034 +02
140	+.10226699 +02	+.20593678 +02	+.30971630 +02	+.41283068 +02	+.51539950 +02	+.61745225 +02
150	+.10260691 +02	+.20632931 +02	+.31077063 +02	+.41442845 +02	+.51740563 +02	+.61987316 +02
160	+.10295782 +02	+.20663861 +02	+.31169307 +02	+.41597749 +02	+.51951091 +02	+.62240286 +02
170	+.10331861 +02	+.20685618 +02	+.31259916 +02	+.41750712 +02	+.52156912 +02	+.62493032 +02
180	+.10368820 +02	+.20737640 +02	+.31340160 +02	+.41904156 +02	+.52373280 +02	+.62759103 +02
190	+.10406521 +02	+.20813043 +02	+.31396424 +02	+.42032760 +02	+.52568594 +02	+.63013829 +02
200	+.10444840 +02	+.20889681 +02	+.31441852 +02	+.42159766 +02	+.52770070 +02	+.63278735 +02

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```
                    HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 5000 FT.    THICKNESS    400 FT.    N-GRADIENT              50  UNITS/1000 FT.

RANGE                                    4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES       10                   20                   30                   40                   50                   60
         ........             ........             ........             ........             ........             ........
010  +.09997853 +02   +.19992390 +02   +.29987826 +02   +.39968960 +02
020  +.10004909 +02   +.20006021 +02   +.30001777 +02   +.39992405 +02   +.49977599 +02   +.59958172 +02
030  +.10016773 +02   +.20028497 +02   +.30033043 +02   +.40031058 +02   +.50022868 +02   +.60008701 +02
040  +.10031504 +02   +.20059411 +02   +.30076170 +02   +.40084810 +02   +.50085410 +02   +.60078873 +02
050  +.10049884 +02   +.20098105 +02   +.30131038 +02   +.40153117 +02   +.50165302 +02   +.60168510 +02
060  +.10070394 +02   +.20143658 +02   +.30197060 +02   +.40235736 +02   +.50261609 +02   +.60277196 +02
070  +.10092752 +02   +.20195311 +02   +.30277955 +02   +.40331801 +02   +.50374175 +02   +.60401973 +02
080  +.10115077 +02   +.20251926 +02   +.30358111 +02   +.40440036 +02   +.50502642 +02   +.60548734 +02
090  +.10137307 +02   +.20312596 +02   +.30450929 +02   +.40560157 +02   +.50645160 +02   +.60710716 +02
100  +.10157000 +02   +.20373635 +02   +.30549968 +02   +.40690560 +02   +.50807691 +02   +.60890297 +02
110  +.10172514 +02   +.20437506 +02   +.30654780 +02   +.40829873 +02   +.50971721 +02   +.61085278 +02
120  +.10182553 +02   +.20496568 +02   +.30762776 +02   +.40977581 +02   +.51151538 +02   +.61290708 +02
130  +.10206357 +02   +.20553874 +02   +.30871411 +02   +.41131099 +02   +.51341361 +02   +.61511028 +02
140  +.10238334 +02   +.20608105 +02   +.30979541 +02   +.41287056 +02   +.51542056 +02   +.61746136 +02
150  +.10271612 +02   +.20648568 +02   +.31087132 +02   +.41447997 +02   +.51743415 +02   +.61980028 +02
160  +.10306080 +02   +.20680866 +02   +.31187133 +02   +.41604673 +02   +.51954791 +02   +.62222972 +02
170  +.10341606 +02   +.20704127 +02   +.31275641 +02   +.41759738 +02   +.52161971 +02   +.62465961 +02
180  +.10378081 +02   +.20756162 +02   +.31358365 +02   +.41915470 +02   +.52379229 +02   +.62761770 +02
190  +.10415346 +02   +.20830692 +02   +.31416216 +02   +.42047189 +02   +.52577068 +02   +.63016760 +02
200  +.10453273 +02   +.20906546 +02   +.31463378 +02   +.42177448 +02   +.52780819 +02   +.63284969 +02
```

TABLE 40

```
                  HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 5000 FT.    THICKNESS    400 FT.    N-GRADIENT           100  UNITS/1000 FT.


RANGE                                  4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                  20                  30                  40                  50                  60
         ........            ........            ........            ........            ........            ........
010   +.09997641 +02      +.19992345 +02      +.29982804 +02      +.39968997 +02
020   +.10004001 +02      +.20005803 +02      +.30001683 +02      +.39992359 +02      +.49977564 +02      +.59958110 +02
030   +.10014171 +02      +.20027965 +02      +.30032818 +02      +.40030938 +02      +.50022797 +02      +.60008653 +02
040   +.10027468 +02      +.20058399 +02      +.30075936 +02      +.40084578 +02      +.50085269 +02      +.60078780 +02
050   +.10043277 +02      +.20096382 +02      +.30130298 +02      +.40152725 +02      +.50165063 +02      +.60168351 +02
060   +.10060407 +02      +.20140890 +02      +.30195917 +02      +.40235129 +02      +.50261235 +02      +.60276951 +02
070   +.10079221 +02      +.20191106 +02      +.30271245 +02      +.40330910 +02      +.50373727 +02      +.60403610 +02
080   +.10097617 +02      +.20245767 +02      +.30355644 +02      +.40438748 +02      +.50501258 +02      +.60548221 +02
090   +.10115903 +02      +.20304020 +02      +.30447396 +02      +.40558355 +02      +.50644895 +02      +.60710221 +02
100   +.10134080 +02      +.20361470 +02      +.30544955 +02      +.40688067 +02      +.50801247 +02      +.60869964 +02
110   +.10147667 +02      +.20421574 +02      +.30647860 +02      +.40826445 +02      +.50969774 +02      +.61084001 +02
120   +.10155525 +02      +.20475896 +02      +.30753379 +02      +.40972954 +02      +.51148922 +02      +.61292080 +02
130   +.10179938 +02      +.20528085 +02      +.30858648 +02      +.41124906 +02      +.51337875 +02      +.61512897 +02
140   +.10213671 +02      +.20577452 +02      +.30962661 +02      +.41278595 +02      +.51537546 +02      +.61743728 +02
150   +.10248464 +02      +.20615371 +02      +.31065669 +02      +.41436982 +02      +.51737310 +02      +.61985360 +02
160   +.10284251 +02      +.20644794 +02      +.31154832 +02      +.41589886 +02      +.51946874 +02      +.62237789 +02
170   +.10320950 +02      +.20664885 +02      +.31242209 +02      +.41740482 +02      +.52151268 +02      +.62489713 +02
180   +.10358449 +02      +.20716899 +02      +.31319692 +02      +.41891347 +02      +.52366172 +02      +.62754921 +02
190   +.10396640 +02      +.20793280 +02      +.31374200 +02      +.42016473 +02      +.52558978 +02      +.63008213 +02
200   +.10435398 +02      +.20870796 +02      +.31417713 +02      +.42139846 +02      +.52757886 +02      +.63271620 +02
```

TABLE 41

HEIGHT DETERMINATION FOR MODEL ATMOSPHE.E WITH TRAPPING LAYERS

TRAPPING LAYER TOP 5000 FT. THICKNESS 400 FT. N-GRADIENT 200 UNITS/1000 FT.

4/3-EARTH HEIGHT IN KILOFEET

RANGE IN MILES	10		20		30		40		50		60	
	....		....		....		....		....		....	
010	+.09997214	+02	+.19992257	+02	+.29982778	+02	+.39968993	+02				
020	+.10002168	+02	+.20005364	+02	+.30001504	+02	+.39992270	+02	+.49977514	+02	+.59958083	+02
030	+.10009796	+02	+.20026896	+02	+.30032366	+02	+.40030699	+02	+.50022654	+02	+.60008563	+02
040	+.10019085	+02	+.20056354	+02	+.30075065	+02	+.40084113	+02	+.50084985	+02	+.60078594	+02
050	+.10029258	+02	+.20092883	+02	+.30128808	+02	+.40151938	+02	+.50164584	+02	+.60168034	+02
060	+.10038577	+02	+.20135218	+02	+.30193607	+02	+.40233907	+02	+.50260486	+02	+.60276458	+02
070	+.10048836	+02	+.20182392	+02	+.30267776	+02	+.40329109	+02	+.50372625	+02	+.60402882	+02
080	+.10057189	+02	+.20232842	+02	+.30350605	+02	+.40436144	+02	+.50499680	+02	+.60547189	+02
090	+.10065428	+02	+.20285801	+02	+.30440141	+02	+.40554699	+02	+.50642745	+02	+.60708502	+02
100	+.10079245	+02	+.20334977	+02	+.30534562	+02	+.40682986	+02	+.50798322	+02	+.60888086	+02
110	+.10087436	+02	+.20386380	+02	+.30633357	+02	+.40819422	+02	+.50965822	+02	+.61081503	+02
120	+.10088989	+02	+.20428806	+02	+.30733463	+02	+.40963408	+02	+.51143595	+02	+.61288784	+02
130	+.10114977	+02	+.20468048	+02	+.30831073	+02	+.41112038	+02	+.51330738	+02	+.61508573	+02
140	+.10152984	+02	+.20505074	+02	+.30925605	+02	+.41260848	+02	+.51528273	+02	+.61738009	+02
150	+.10191491	+02	+.20535862	+02	+.31017719	+02	+.41413606	+02	+.51724654	+02	+.61977856	+02
160	+.10230534	+02	+.20557319	+02	+.31092136	+02	+.41557926	+02	+.51930339	+02	+.62228167	+02
170	+.10270093	+02	+.20568637	+02	+.31164077	+02	+.41698235	+02	+.52128870	+02	+.62476018	+02
180	+.10310132	+02	+.20620264	+02	+.31228106	+02	+.41837666	+02	+.52337746	+02	+.62738591	+02
190	+.10350589	+02	+.20701179	+02	+.31273324	+02	+.41946182	+02	+.52519658	+02	+.62986001	+02
200	+.10391392	+02	+.20782785	+02	+.31306755	+02	+.42052230	+02	+.52707418	+02	+.63243250	+02

TABLE 42

HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS

```
TRAPPING LAYER TOP 5000 FT.    THICKNESS    800 FT.    N-GRADIENT           60  UNITS/1000 FT.

RANGE                                  4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                    20                    30                    40                    50                    60
         ........              ........              ........              ........              ........              ........
010  +.09997457 +02    +.19992306 +02    +.29982755 +02    +.39969020 +02
020  +.10003216 +02    +.20005613 +02    +.30001606 +02    +.39992319 +02    +.49977545 +02    +.59958061 +02
030  +.10012311 +02    +.20027506 +02    +.30032623 +02    +.40030835 +02    +.50022735 +02    +.60008613 +02
040  +.10023948 +02    +.20057523 +02    +.30075562 +02    +.40084378 +02    +.50085146 +02    +.60078700 +02
050  +.10037480 +02    +.20094889 +02    +.30129659 +02    +.40152387 +02    +.50164857 +02    +.60168214 +02
060  +.10051579 +02    +.20138484 +02    +.30194927 +02    +.40234604 +02    +.50260913 +02    +.60276738 +02
070  +.10067180 +02    +.20187438 +02    +.30269764 +02    +.40330137 +02    +.50373253 +02    +.60403297 +02
080  +.10081967 +02    +.20240379 +02    +.30353500 +02    +.40437633 +02    +.50500581 +02    +.60547777 +02
090  +.10096634 +02    +.20296494 +02    +.30444325 +02    +.40556794 +02    +.50643973 +02    +.60709612 +02
100  +.10113384 +02    +.20350725 +02    +.30540585 +02    +.40685904 +02    +.50799995 +02    +.60889158 +02
110  +.10125170 +02    +.20407448 +02    +.30641810 +02    +.40823467 +02    +.50968087 +02    +.61082931 +02
120  +.10130900 +02    +.20457436 +02    +.30745139 +02    +.40968926 +02    +.51146654 +02    +.61290670 +02
130  +.10155956 +02    +.20504936 +02    +.30847394 +02    +.41119504 +02    +.51334847 +02    +.61511051 +02
140  +.10191265 +02    +.20549855 +02    +.30947720 +02    +.41271209 +02    +.51533623 +02    +.61741293 +02
150  +.10227432 +02    +.20585386 +02    +.31046590 +02    +.41427317 +02    +.51731988 +02    +.61982175 +02
160  +.10264417 +02    +.20612124 +02    +.31130403 +02    +.41576850 +02    +.51939958 +02    +.62233717 +02
170  +.10302179 +02    +.20629255 +02    +.31212171 +02    +.41723441 +02    +.52141977 +02    +.62484285 +02
180  +.10340611 +02    +.20681222 +02    +.31284845 +02    +.41869921 +02    +.52354443 +02    +.62748071 +02
190  +.10379640 +02    +.20759281 +02    +.31336221 +02    +.41989010 +02    +.52543007 +02    +.62998978 +02
200  +.10419153 +02    +.20838306 +02    +.31376329 +02    +.42106082 +02    +.52737572 +02    +.63259890 +02
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TABLE 43

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                  HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 5000 FT.   THICKNESS   800 FT.   N-GRADIENT        100  UNITS/1000 FT.


RANGE                                 4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES     10               20               30               40               50               60
        ........         ........         ........         ........         ........         ........
010  +.09996745 +02   +.19992161 +02   +.29982750 +02   +.39968989 +02
020  +.10000158 +02   +.20004882 +02   +.30001308 +02   +.39992172 +02   +.49977460 +02   +.59958055 +02
030  +.10005003 +02   +.20025723 +02   +.30031870 +02   +.40030436 +02   +.50022498 +02   +.60008464 +02
040  +.10009919 +02   +.20054111 +02   +.30074110 +02   +.40083602 +02   +.50084674 +02   +.60078390 +02
050  +.10013969 +02   +.20089746 +02   +.30127174 +02   +.40151075 +02   +.50164059 +02   +.60167685 +02
060  +.10014872 +02   +.20129006 +02   +.30191073 +02   +.40232567 +02   +.50259664 +02   +.60275917 +02
070  +.10015983 +02   +.20172860 +02   +.30263972 +02   +.40327133 +02   +.50371415 +02   +.60402063 +02
080  +.10013705 +02   +.20218726 +02   +.30345081 +02   +.40433289 +02   +.50497948 +02   +.60546058 +02
090  +.10011334 +02   +.20265932 +02   +.30432197 +02   +.40550690 +02   +.50640387 +02   +.60707244 +02
100  +.10020632 +02   +.20306186 +02   +.30523195 +02   +.40677418 +02   +.50795114 +02   +.60886025 +02
110  +.10023220 +02   +.20348206 +02   +.30617517 +02   +.40811730 +02   +.50961490 +02   +.61078762 +02
120  +.10018229 +02   +.20378006 +02   +.30711737 +02   +.40952961 +02   +.51137756 +02   +.61285170 +02
130  +.10045875 +02   +.20403486 +02   +.30801069 +02   +.41097966 +02   +.51322921 +02   +.61503831 +02
140  +.10088453 +02   +.20427429 +02   +.30885372 +02   +.41241469 +02   +.51518120 +02   +.61731741 +02
150  +.10130900 +02   +.20450818 +02   +.30965790 +02   +.41388107 +02   +.51710811 +02   +.61969635 +02
160  +.10173376 +02   +.20463964 +02   +.31024555 +02   +.41523154 +02   +.51912263 +02   +.62217632 +02
170  +.10215966 +02   +.20466131 +02   +.31080108 +02   +.41652361 +02   +.52104426 +02   +.62462712 +02
180  +.10258698 +02   +.20517396 +02   +.31129871 +02   +.41779506 +02   +.52306750 +02   +.62720735 +02
190  +.10301569 +02   +.20603139 +02   +.31165423 +02   +.41870362 +02   +.52476906 +02   +.62961749 +02
200  +.10344539 +02   +.20689079 +02   +.31188327 +02   +.41957994 +02   +.52652635 +02   +.63212304 +02


                                         TABLE 44
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```
                          HEIGHT DETERMINATION FOR MODEL ATMOSPHERE WITH TRAPPING LAYERS


TRAPPING LAYER TOP 5000 FT.    THICKNESS    800 FT.    N-GRADIENT           '200  UNITS/1000 FT.

RANGE                                   4/3-EARTH HEIGHT  IN KILOFEET
 IN
MILES      10                 20                 30                 40                 50                 60
          ........           ........           ........           ........           ........           ........
010  +.09995315 +02  +.19991868 +02  +.29982664 +02  +.39968976 +02
020  +.09993931 +02  +.20003411 +02  +.30000711 +02  +.39991875 +02  +.49977295 +02  +.59957967 +02
030  +.09989752 +02  +.20022120 +02  +.30030356 +02  +.40029636 +02  +.50022022 +02  +.60008162 +02
040  +.09979535 +02  +.20047156 +02  +.30071180 +02  +.40082044 +02  +.50083725 +02  +.60077769 +02
050  +.09960483 +02  +.20076985 +02  +.30122132 +02  +.40148431 +02  +.50162455 +02  +.60166623 +02
060  +.09924562 +02  +.20109093 +02  +.30183204 +02  +.40228446 +02  +.50257148 +02  +.60274266 +02
070  +.09879237 +02  +.20141503 +02  +.30252047 +02  +.40321030 +02  +.50367701 +02  +.60399638 +02
080  +.09812617 +02  +.20170682 +02  +.30327558 +02  +.40424407 +02  +.50492609 +02  +.60542586 +02
090  +.09747400 +02  +.20196182 +02  +.30406576 +02  +.40538123 +02  +.50633085 +02  +.60702451 +02
100  +.09711219 +02  +.20197706 +02  +.30485684 +02  +.40659783 +02  +.50785124 +02  +.60879660 +02
110  +.09662620 +02  +.20198806 +02  +.30563791 +02  +.40787040 +02  +.50947903 +02  +.61070262 +02
120  +.09599658 +02  +.20155265 +02  +.30635871 +02  +.40918895 +02  +.51119278 +02  +.61273898 +02
130  +.09631483 +02  +.20099568 +02  +.30690627 +02  +.41051275 +02  +.51297893 +02  +.61488950 +02
140  +.09701050 +02  +.20042633 +02  +.30730437 +02  +.41175169 +02  +.51485292 +02  +.61711897 +02
150  +.09766900 +02  +.19998613 +02  +.30753756 +02  +.41298852 +02  +.51665128 +02  +.61943336 +02
160  +.09829842 +02  +.19937733 +02  +.30720267 +02  +.41394869 +02  +.51851529 +02  +.62183608 +02
170  +.09890482 +02  +.19859462 +02  +.30679666 +02  +.41475889 +02  +.52019795 +02  +.62416317 +02
180  +.09949262 +02  +.19898524 +02  +.30636021 +02  +.41545546 +02  +.52197468 +02  +.62661307 +02
190  +.10006501 +02  +.20013002 +02  +.30585021 +02  +.41532759 +02  +.52316638 +02  +.62878465 +02
200  +.10062417 +02  +.20124835 +02  +.30514889 +02  +.41512615 +02  +.52440275 +02  +.63103986 +02
```

TABLE 45

thesR85
Correction tables for altitude determini
3 2768 001 96980 1
DUDLEY KNOX LIBRARY